THE *TENUIS* GROUP OF *LEPTHYPHANTES* MENGE (ARANEAE, LINYPHIIDAE)

by

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With 69 text-figures

INTRODUCTION

Within the Linyphiidae, the genus *Lepthyphantes* is one of the largest. It is rich in species, which are found in a wide range of habitats, from the Arctic in the north to the Mediterranean in the south, at high altitudes in the Alps as well as in the lower parts of Europe. In Asia, North America, and Africa they occur in comparable situations. A number of species have also been described from other parts of the world, but at least some of these we may regard sceptically. Even with this restriction there is an overwhelming amount of species and the genus is notorious for that very reason. The inaccessibility of the genus is aggravated by the many poor descriptions without, or with inadequate, illustrations.

Several authors have tried to arrange the species into natural, monophyletic groups. One of these groups, the *tenuis* group, will be discussed in this paper. As already pointed out by Wanless (1973: 139), this group is not sharply limited. Notably species as *L. alacris* (Blackwall) and its near relatives are, at least morphologically, close to the *tenuis* group, but for practical reasons we have restricted ourselves to the species-group as delimited by Simon (1929, "4e Groupe", p. 589), Locket & Millidge (1953, "Group III", p. 384), and Wiehle (1956, "IV. *Tenuis*-Gruppe", p. 191). We have included as many species as possible which from their descriptions, and above all from the illustrations, could be referred to this species-group. Inevitably some may have escaped attention, because the available descriptions lacked any indication of their belonging to the group dealt with here.

Many species of the *tenuis* group are very common and widely distributed, and every ecologist will collect large series of certain species in his pitfalls or through hand-collecting. Still the identification even of the common species is far from easy, because the palps and epigynes are very small, while the characters commonly used for recognition of the species are found in the shapes of the different elements of these organs. The shapes vary with the angle of vision and even a slight expansion of the haematodocha, as it is sometimes found in preserved specimens, may present a very different picture. As a rule, the major collections examined in recent years contained many a misidentification, a clear demonstration of the difficulties presented by this group. It also compels us to make a very critical use of literature records.

It was thought to be helpful to give a summary of all known species of this group, presenting also their diagnostic characters, their geographical variations, their distributions and ecological requirements (where possible). Wanless (1971) already published a series of excellent illustrations, photographic pictures and line-drawings, of the epigynes of the West-European species. They are of great help and one realizes how badly similar figures of the male palps are needed. If all former descriptions had been furnished with such illustrations, a revision of *Lepthyphantes* would have been a less time-consuming task.

The main object being to expound our modern views concerning this group, we nevertheless have also tried to bring the nomenclature up to date. The present situation is far from satisfactory in view of the fact that many of the older names were listed as synonyms by authors such as Blackwall, Thorell and Pickard-Cambridge. Apparently they were in contact with each other from time to time, as Thorell, for instance, actually was able to compare many examples of Blackwall's species with his own specimens. This often resulted in the recognition of synonymies, and from then onward a name could be unanimously treated as such. The difficulty lies in the supposition, or near certainty, that recognition of species was a matter of general appearance rather than of a study of the genitalia, stridulating files and other structural characters we now consider of paramount importance. This latter method started with Blackwall, Kulczyński, and Simon, but we still have to deal with an inheritance of species described with the use of coloration and abdominal patterns only and listed as junior synonyms of currently used names. It is beyond our possibilities to evaluate the earlier decisions, given mainly by Kulczyński and Chyzer & Kulczyński. However, a re-examination of some of the old collections gives one the strong impression that the recognition of many of the *Lepthyphantes* species proved to be difficult even to the more advanced arachnologists. Too many series were found to consist of more than one species. It makes it the more important to stabilize the present situation by procuring useful means for the identification of the species.

THE *TENUIS* GROUP

Leptyphantes, 4e Groupe, Simon, 1929: 589.
Lepthyphantes, Group III, Locket & Millidge, 1953: 384.
Lepthyphantes, IV. *Tenuis*-Gruppe, Wiehle, 1956: 191.
Lepthyphantes, Group 1(a), Wanless, 1973: 139.

Within the large and rather heterogeneous genus *Lepthyphantes* the *tenuis* group has been recognized by most authors as a distinct group. It can be easily distinguished from most of the other currently recognized species-groups, though

Wanless (1973: 139) indicated the weak points in the system of grouping. He suggested a much finer subdivision of the genus into species-groups and subgroups, at the same time pointing out the transitions from one group to the other. In his grouping of the species — working with the British species and basing his conclusions on a study of the female genitalia only — all species usually referred to the *tenuis* group are kept together in his group 1(a), while *L. alacris* (Blackwall) (group 1 (b)), and *L. leprosus* (Ohlert) and *L. minutus* (Blackwall) (group 1 (c)), are thought to be very closely related to the *tenuis* group proper. These three species have an epigyne comparable in structure to that of *tenuis,* but it is larger and more complicated. It is our present opinion that *cristatus* takes a rather isolated position within the *tenuis* group and shows an affiliation with the three species placed near the *tenuis* group by Wanless.

Though recognized by most authors as a homogeneous species-group, it is not easy to delimit the group clearly. Our diagnosis is given below. Without a detailed study of the other species-groups it cannot but have its imperfections.

Diagnosis of the *tenuis* group. Comparisons with other species-groups are given in square brackets.

Medium-sized animals (1.7—4.1 mm) in comparison with the other species-groups of the genus. Abdomen of female with a dorsal pattern of transverse blackish bars and white blotches on the intervening areas, and with light or white longitudinal lateral band [cf. *pallidus* group, where faint bars may be present]; pattern obscure in the male. Chelicerae with three dorsal and three ventral teeth, slightly modified in the male; stridulating files always present. Femora spineless with the exception of a prolateral spine on femur I. Tibia I with one pro- and one retrolateral spine, tibia II with one retrolateral spine, in addition to the two dorsal spines; tibiae III and IV without lateral spines (but with one retrolateral spine in *cristatus*); no ventral spines present [cf. *L. expunctus, mughi,* etc.]. Metatarsi with a single dorsal spine (but with several spines in *spiniger*) [cf. *nebulosus* group, where several spines are present]. Tm I (0.15—) 0.20—0.25 (—0.30) [cf. *obscurus* group]. Male palpal tibia with one spine (or more: *cristatus*), which is at least as strong and long as the patellar spine [cf. *obscurus, pallidus, expunctus, mughi,* and related species]. Cymbium rather simple, without tubercles or horns (but with small tubercle in *cristatus*) [cf. *obscurus* group, *nebulosus* group]. Epigyne moderately large, not much protruding from the ventral surface of the abdomen [cf. *nebulosus* group]. Scape simple-folded [cf. *alacris,* where it is invaginated, see Wanless, 1973: 141, figs. 24D—E].

General structure of the secondary genitalia.

Male palp (Fig. 3, 5). — Cymbium (*c*) not modified, except in *cristatus*, where a basal latero-dorsal projection is present. Paracymbium (*pc*) relatively simple in comparison with other species-groups within the genus; distal branch of the roughly U-shaped element ending in a flat, blade-like tip; in most species one or more teeth present on basal branch or middle section. Haematodocha and tegular section without diagnostic features on species level; median apophysis (*ma*) always with acute tip, which points outward just below tip of cymbium (generic character). All other elements attached to each other and to radix by membranes, forming together the radical complex, which looks rather rigid in its mutual cohesion. Radix (*r*) always distinctly curved, other elements implanted on basal and concave middle part (as oriented in the unexpanded palp). Lamella (*l*) in most species S-shaped, membranous or lightly sclerotized, free tip usually incised, forked, or composed of several branches; element conspicuous in lateral aspect. Embolus (*e*) a sinuous element which broadens out halfway into an often dentigerous protrusion, then, after a narrow middle section, widens into a more voluminous apical section, which is bifid, one of the tips being the spermduct-tooth. Terminal apophysis (*ta*) consisting of membranous sclerites and chitinous tooth or teeth, situated between embolus and lamella. Embolic membrane (*em*) small, covering tip of embolus in the unexpanded palp.

Main diagnostically important characters are: positions and size of tooth or teeth on paracymbium; shape of lamella; absence, presence, number, and size of teeth on basic section of embolus.

Epigyne (Fig. 1, 2). — Essentially not differing from general structure of this organ in other species-groups of the genus (see Wanless, 1973, for a schematic representation of different degrees of complexity). Atrium surrounded by more or less unmodified, sclerotized anterior and lateral walls; atrium bordered posteriorly by the posterior median plate (*mp*) (subgenital sclerite of Wanless), which in all species of the *tenuis* group is deeply incised medially; lateral margins of posterior median plate in posterior view of the uncleared epigyne indicated by the two darker (more sclerotized) fertilization-ducts. Atrium for the major part covered by the scape, which runs from its base on the anterior wall of the atrium in posterior direction; scape in all species of the *tenuis* group composed of a more or less straight basal part, reaching as far as the posterior median plate, then rather abruptly curving to the dorsal side and forward again (inside, and out of view) and continuing as a second, arched, inner section, the stretcher (*st*) on the extreme tip reaching the posterior side of the epigyne just between transition of basal into arched section and posterior median plate; stretcher always visible in the ventral aspect at the posterior tip of the visible scape as a round, protruding knob and furnished with a pit or socket; ventral aspect of epigyne allowing of a view of the exposed basal part of the scape, bordered at either side by the lateral wing-like extensions of the first part of the arched, second section of the scape, which in most species is distinctly wider than the anterior half of the basal part of the scape, and often of characteristic shape. In the unexpanded or uncleared epigyne, the tip of the arched part of the scape remains invisible, with the exception of the stretcher; on this tip are to be found two lateral sockets (see below) and, slightly more medially, the entrances of the two spermducts, which run from these pores symmetrically and often parallel through the whole length of the scape and the anterior and lateral walls of the atrium, each curving to its own side, to the receptacula seminis.

Functional aspects. — A general understanding of the functioning of the type of secondary genitalia found in this species-group may be obtained by comparison of the structures found here and in *Lepthyphantes leprosus* (Ohlert), a representative of another species-group. The functioning of the genital organs in the latter species have been studied by one of us (Van Helsdingen, 1965), and though we should be aware of the dangers that attach to a too hasty generalization, we may safely assume at least some of the elements to function in a similar way.

The presence in the epigyne of a long, curved scape and a characteristically built male embolus (with its typical, voluminous, double-tipped and at one side grooved apical section), most probably correlate with each other: in functional contact the curved part of the scape is pulled around the apical section of the embolus in such a way, that one tip of the embolus fits into one of the lateral sockets at the tip of the scape (when the left palp is used it is pushed into the left socket, and vice versa), while the other tips, the spermduct-tooth, disappears into the entrance of the female spermduct at the same side of the scape. The scape is pulled out and kept in place by means of the median apophysis, the tip of which element grips the stretcher at the tip of the scape, using the socket at the stretcher's knob-shaped tip as a foothold, during the very first moments of contact between palp and epigyne. Leaving the movements of the different elements out of consideration, we may assume to find, in the final situation, the male palp firmly anchored on the epigyne through the combined forces of the paracymbium (anchored on the scape), the radix (on the scape), the terminal apophysis (within the atrium and on the posterior median plate), and the lamella (on the posterior median plate, in co-operation with the terminal apophysis). Whether the scape is lifted out of its resting position and twisted sideways, as was observed in *L. leprosus*, is questionable, but, though likely, not necessarily the case. It would be very interesting to learn what variations are possible on the theme found in *leprosus*, not only in order to understand the intricate movements of the scape, but also to find out the possible function of the tooth, or teeth in some species, on the paracymbium.

KEY TO THE RECOGNIZED PALAEARCTIC SPECIES

Males

1. Palpal tibia with four spines, cymbium with a dorso-lateral tubercle near its base (Fig. 52) . . . . *cristatus* (p. 40)
— Palpal tibia with a single spine, cymbium without a dorso-lateral tubercle near its base 2
2. Posterior margin of paracymbium with tooth or teeth 3
— Posterior margin of paracymbium without tooth, or, at the most, with a ridge 12
3. Paracymbium with small tooth at posterior margin only (Fig. 9) 4
— Posterior margin of paracymbium with a large tooth (Fig. 47); or posterior margin with two teeth (Fig. 33); or a second tooth present at anterior margin of basal branch (Fig. 18) or at base of distal branch (Fig. 36) 9
4. Length of cephalothorax 0.95 mm or less 5
— Length of cephalothorax 0.95 mm or more 7
5. Embolus without denticles 6
— Embolus with denticles along ventral margin of basal section . *perseus* (p. 11)

6. Stridulating files fine (Fig. 55); chelicerae without latero-basal boss; lamella sickle-shaped (Fig. 5) . . . . *mengei* (p. 8)
— Stridulating files coarse and often obscure (Fig. 56, ♀!); chelicerae with latero-basal boss (Fig. 12); terminal and subterminal parts of lamella more straight, not sickle-shaped (Fig. 9) . . . . *flavipes* (p. 12)
7. Metatarsi with one dorsal spine only; basal section of embolus with 7 denticles or less 8
— Metatarsi with several spines; basal section of embolus with about 11 denticles (Fig. 29); lamella (Fig. 28) with longest branch forked at tip; stridulating files very fine (Fig. 62) . . . . *spiniger* (p. 27)
8. Stridulating files very coarse (Fig. 60); basal section of embolus with 4 denticles (Fig. 23); dorsal branch of distal part of lamella bluntly truncated (Fig. 22) . . . . *drenskyi* (p. 22)
— Stridulating files less coarse (Fig. 61); basal section of embolus with 7 denticles (Fig. 26); small tooth at posterior margin of paracymbium pointing backwards (Fig. 27) . . . . *zimmermanni* (p. 23)
9. Larger specimens (length cephalothorax 1.2 mm or more); tooth at posterior margin of paracymbium large (Fig. 47); distal branches of lamella diverging (Fig. 47); stridulating files fine (Fig. 67) . . . . *nigriventris* (p. 36)
— Smaller specimens (length cephalothorax 1.1 mm or less) 10
10. Only one tooth present at posterior margin of paracymbium 11
— Two teeth at posterior margin of paracymbium (Fig. 33) . . . *floriana* (p. 28)
11. Large second tooth present on paracymbium just inside distal branch (Fig. 36); lamella large but simply curved (Fig. 36) . . . . *tenebricola* (p. 30)
— Small second tooth on paracymbium situated at anterior margin of proximal branch (Fig. 18); lamella smaller, with bluntly tipped dorsal branch (Fig. 18) . . . . *tenuis* (p. 17)
12. No tooth present on paracymbium (Fig. 20); cephalothorax with a dark median vitta . . . . *tenebricoloides* (p. 21)
— Paracymbium with distinct tooth, large or small 13
13. Paracymbium with a denticle near anterior margin of proximal branch (Fig. 13); specimens small (length cephalothorax 0.9 mm or less); lamella (Fig. 13) hardly curved . . . . *herbicola* (p. 16)
— Paracymbium with a large tooth near base of distal branch; specimens larger 14
14. Distal branches of lamella parallel (Fig. 45); stridulating files fine (Fig. 66) . . . . *jacksonoides* (p. 34)
— Distal branches of lamella distinctly diverging (Fig. 39); stridulating files rather coarse (Fig. 65) . . . . *jacksoni* (p. 32)

Females

1. Tibiae III and IV with an l-spine in addition to the two d-spines; epigyne, Fig. 54 . . . . *cristatus* (p. 40)
— Tibiae III and IV with the usual pair of d-spines only 2
2. Visible basal section of scape with a medial pit (Fig. 49, 51), or with a

depression near the broadened tip (Fig. 42, 46) 3

— Visible part of scape without a medial pit, nor with a depressed area near its tip 6

3. Basal part of scape with a medial pit (Fig. 49) 4

— Basal part of scape with a depressed area near tip (Fig. 42) 5

4. Larger specimens, with length of cephalothorax more than 1.20 mm, femur I 1.5 mm or longer: two (sub)species which differ only slightly in the shape of their scapes (Fig. 49 and 51) and in their provenance . . . . *nigriventris* (p. 36) and *camtschaticus* (p. 38)

— Smaller specimens: length cephalothorax less than 1.20 mm, femur I not longer than 1.30 mm; scape of epigyne with a transverse, pigmented (sclerotized) ridge at transition of exposed basal part and curved inner part (Fig. 38); medial pit not always present (see also couplet 8) *tenebricola* (p. 30)

5. Stridulating files rather coarse (Fig. 65) . . . . *jacksoni* (p. 32)

— Stridulating files finer (Fig. 66) . . . . *jacksonoides* (p. 34)

6. Visible part of scape gradually widening with concave margins from base to posterior end, without parallel-sided anterior section, the margins reaching broadest point of scape without any interruption 7

— Visible part of scape roundish or with lateral lobes, not gradually widening with concave margins, but often with a distinctly parallel-sided anterior section; or, if gradually widening, then lateral margins not reaching broadest point of scape without any interruption 9

7. Larger specimens: length cephalothorax 1.25—1.55, length femur I 1.50—1.80 mm; cephalothorax with a dark grey median streak, abdomen with paired black spots, otherwise light; stridulating files rather fine (Fig. 59) . . . . *tenebricoloides* (p. 21)

— Smaller specimens 8

8. Scape with distinct, more sclerotized, transverse ridge at posterior margin of exposed part; most specimens with a trace of a medial depression or pit at half length of scape, in some specimens this pit distinctly developed (Fig. 37 and 38) (see also couplet 4); posterior median plate not much broader than scape; lateral lobes of inner part of scape with convex margins; width of scape 0.17—0.22 mm . . . . *tenebricola* (p. 30)

— Scape without distinct transverse ridge; posterior median plate distinctly wider than scape; lateral lobes with concave margins (Fig. 15); width of scape 0.12—0.15 mm . . . . *herbicola* (p. 16)

9. Scape with parallel-sided basal "stem" or gradually widening in posterior direction 10

— Exposed part of scape with lateral lobes near base, or broadly rounded 13

10. Scape distinctly anchor-shaped, with narrow, parallel-sided "stem" gradually widening into transverse posterior part; inner, curved part of scape visible as strongly rounded lobes; posterior median plate not much wider than scape (Fig. 16); width of scape 0.13—0.15 mm; stridulating files rather coarse (Fig. 58) . . . . *tenuis* (p. 17)

— Lateral lobes not rounded 11

11. Metatarsi with more than one spine; stridulating files very fine (Fig. 62) . . . . *spiniger* (p. 27)
— Metatarsi with a single d-spine; stridulating files not very fine 12
12. Lateral lobes of inner part of scape with rather even concave margin towards broadest point, from there curved inward (Fig. 24); scape slightly narrower than in next species (width of outer scape 0.150—0.175, of inner scape 0.150—0.175 mm) . . . . *zimmermanni* (p. 23)
— Lateral lobes with a small but distinct projection just in front of broadest point, hence margin in front of broadest point not evenly concave (Fig. 34); scape slightly wider than in former species (width of outer scape 0.175—0.190, of inner scape 0.185—0.200 mm) . . . . *floriana* (p. 28)
13. Exposed part of scape with lateral, wing-like extensions on anterior half (Fig. 4); stridulating files fine (Fig. 55) . . . . *mengei* (p. 8)
— Exposed part of scape more or less evenly rounded, i.e. without incisions and without distinct, more or less parallel-sided basal "stem" (Fig. 11); stridulating files very coarse, hardly visible (Fig. 56) . . . . *flavipes* (p. 12)

Lepthyphantes mengei Kulczyński
(Fig. 3—5, 55)

Lepthyphantes mengei Kulczyński, 1887: 267, 320, Pl. 7 Fig. 37—39 (descr. ♀ ♂ ; Poland). Miller, 1947: 26, 29, 40, 79, Pl. 12 Fig. 8—11, 14, Pl. 13 Fig. 1 (♀ ♂). Locket & Millidge, 1953: 388, Fig. 231 A, C, E, 232 C, D (♀ ♂). Wiehle, 1956: 202, Fig. 340—344 (♀ ♂). Wanless, 1971: 22, 26, Pl. 2, Pl. 6 Fig. F (♀); 1973: 129, 134, Pl. 1 Fig. 6, Pl. 6 Fig. 6 (♀).

Lepthyphantes gallicus Simon, 1929: 591, 594, 734, Fig. 906—907 (descr. ♀ ♂ ; France). Jackson, 1930: 653 (= *mengei*).

Linyphia concinna L. Koch, 1879: 37, Pl. 1 Fig. 26 (descr. ♀; Siberia). Preoccupied by *Linyphia concinna* Thorell, 1875 [= *Centromerita concinna* (Thorell)].

Linyphia tomskica Strand; Ermolajev, 1934: 130 (nom. nov. pro *Linyphia concinna* L. Koch, 1879).

Linyphia concinnella Roewer, 1942: 578 (nom. nov. pro *Linyphia concinna* L. Koch, 1879).

Lepthyphantes concinnus; Holm, 1945: 8, 56 (as senior synonym of *Lepthyphantes mengei* Kulczyński).

Remarks. — Despite the recent discovery (see Locket, Millidge & Van Helsdingen, 1970: 90) that the type-series of *Linyphia tenebricola* Wider, 1834, belongs to the species currently known as *Lepthyphantes mengei* Kulczyński, 1887, we maintain the name commonly used before that discovery. A proposal to stabilize this situation has been presented to the International Commission on Zoological Nomenclature. See also under remarks on *Lepthyphantes tenebricola* (Wider).

Both Strand and Roewer published replacement names for *Linyphia concinna* L. Koch, 1879, because it was preoccupied by *Linyphia concinna* Thorell, 1875. Holm (1945) re-examined Koch's material and found it to be synonymous with *Lepthyphantes mengei*. However, by placing *L. mengei* as a junior synonym of *Lepthyphantes concinnus* he forgot to deal with the problem of the preoccupation. Subsequently he corrected this error by placing *L. concinna* as synonym of *mengei*, the only valid solution.

The original material of *Linyphia concinna* L. Koch (1♂ 2♀) is preserved in Stockholm (NRS). Original material of *Lepthyphantes gallicus* Simon could not be

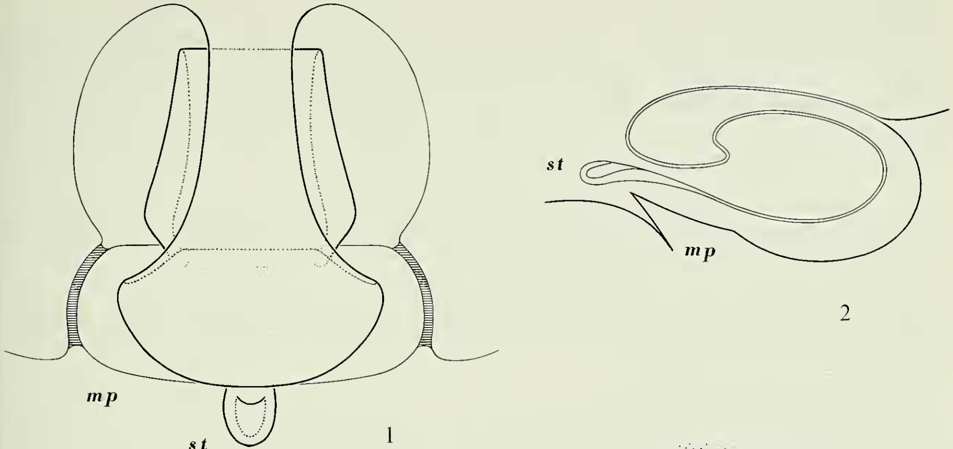

Fig. 1—2. Schematic representation of epigyne in *Lepthyphantes*. 1, ventral aspect; 2, lateral aspect (*mp*, posterior median plate; *st*, stretcher).

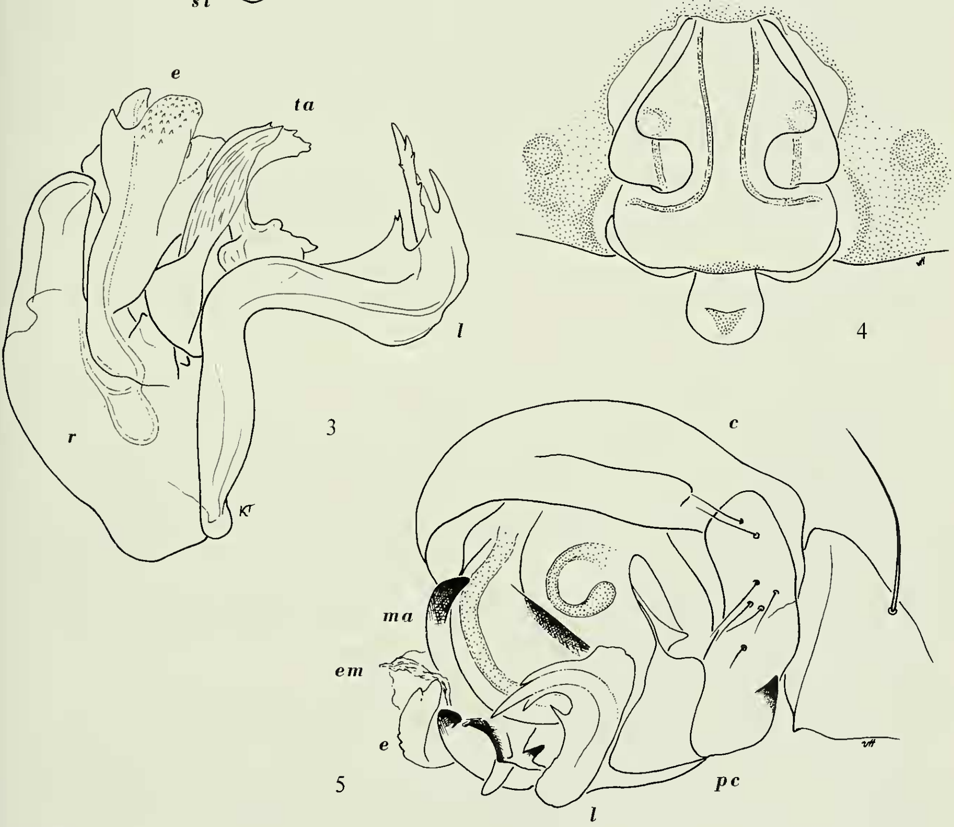

Fig. 3—5. *Lepthyphantes mengei* Kulczyński. 3, radical section of male palp, ventral aspect; 4, epigyne; 5, male palp, lateral aspect (*c*, cymbium; *e*, embolus; *em*, embolic membrane; *l*, lamella; *ma*, median apophysis; *pc*, paracymbium; *r*, radix; *ta*, terminal apophysis). 3, X 440; 4, X 225; 5, X 180

traced with any certainty, but all material in the Simon collection under that name has been examined (MP). Neglecting the presence of a few specimens of other species — a not unusual sample pollution of *Lepthyphantes* in old collections — all *gallicus* material belongs to *mengei*, and Jackson's (1930) statement can only be confirmed.

Diagnosis. — *L. mengei* belongs to the smaller species of the group. The fine stridulating files distinguish it at once from *L. flavipes* (Blackwall), the shapes of the lamella and epigyne are quite characteristic.

Measurements (in mm). Total length, ♀ 1.9—2.5, ♂ 1.8—2.2; length cephalothorax, ♀ 0.80—0.92, ♂ 0.80—0.95. Legs: Fe I 1.15—1.30 times length cephalothorax in ♀, 1.20—1.35 in ♂.

Stridulating files fine (Fig. 55).

Male palp (Fig. 3,5) characterized by the comparatively obtuse (if compared with *flavipes*) tooth on the posterior margin of the paracymbium, the sickle-shaped lamella which is provided with a dorsal lobe, the tongue-shaped structure of the terminal apophysis as seen in the lateral aspect, and the absence of denticles on the basal part of the embolus. The tooth on the paracymbium lies rather far to the ventral side. Length of cymbium 0.28—0.37 mm.

Epigyne (Fig. 4). Basal part of scape roughly anchor-shaped but anterior portion furnished with lateral wings, which slightly protrude in ventral direction; inner part of scape visible as a slightly projecting lobe at either side of the scape in the incisions between tips of anchor and lateral wings; stretcher as usual. Posterior median plate hardly wider than scape. Width of basal part of scape 0.12—0.15, of posterior median plate 0.13—1.17 mm.

Distribution. — Bonnet could list the species from most European countries within the following boundaries: the British Isles, Iceland, Scandinavia, the European U.S.S.R. and West Siberia, the Balkans, Austria, Switzerland, and France. It has also been recorded from Greenland (Bonnet, 1957: 2432), but this was proven to be incorrect (Braendegård, 1958: 87). Recent records, later than 1940, include again Siberia (Holm, 1970), Finland (Lehtinen & Kleemola, 1962; Huhta, 1965, 1971; Palmgren, 1972), Estland (Vilbaste, 1973), Lapland (Holm, 1945, 1952, 1959), Iceland (Cloudsley-Thompson, 1948; Braendegård, 1958), and most other countries within the boundaries mentioned.

A cave record from Rumania (Denis, 1952: 12) was based on four specimens (MP, re-examined) which appeared to belong to *L. flavipes* (Blackwall).

We have studied material from Austria (Tirol, Osttirol, common), Czechoslovakia (Böhmen, common), Switzerland (Schwyz, Glarus, Engadin), northern Italy (Bergamo, Lago di Garda, up to 1800 m), Holland (common), Norway (specimens in coll. Strand, MP), and Iceland (MP). We could also re-examine the numerous specimens from the Paris collection (many with labels bearing the name *L. gallicus* Simon!). Figures based on specimens from Holland.

L. mengei thus seems to be absent from mediterranean Italy and from Spain, Portugal and Greece. In the north it far exceeds the distribution of *L. flavipes* (Blackwall), and the occurrence in Iceland, Lapland and Siberia shows an ability to survive in subarctic regions. In the Alps (and Pyrenees?) it has been found at higher elevations (up to 1800 m) than *flavipes* (up to 1200 m), demonstrating the same climatic tolerance.

In Central Europe it is one of the commonest species of the *tenuis* group. It occurs in leaf-litter, moss, sphagnum, and under stones. Adult specimens are found at all seasons (Braun & Rabeler, 1969: 43; Palmgren, 1975: 60).

Lepthyphantes perseus Van Helsdingen, spec. nov.
(Fig. 6—8, 69)

Holotype: ♂, from Iran, Assalem, 2300 m, beech forest, v.1975, Ressl leg.; 2♂ paratypes from same locality (holotype in SMF, paratypes in personal collection of J. Wunderlich and ML).

The three above specimens were entrusted to us for inclusion in our present paper by Mr. J. Wunderlich of Neuenburg, Germany. Originating from a hardly investigated region as Iran they are of great interest. The specimens much resemble *mengei*, but differ in the shape of the lamella, terminal apophysis, and in the dentition of the embolus. In size, coloration, cheliceral dentition, and stridulating files there are hardly any differences between these species. On the basis of the observed differences we treat this taxon as a separate species.

Measurements (in mm). Male. Total length 1.8—2.05, length cephalothorax 0.82—0.87. Legs: Fe I 1.20—1.35 times length cephalothorax.

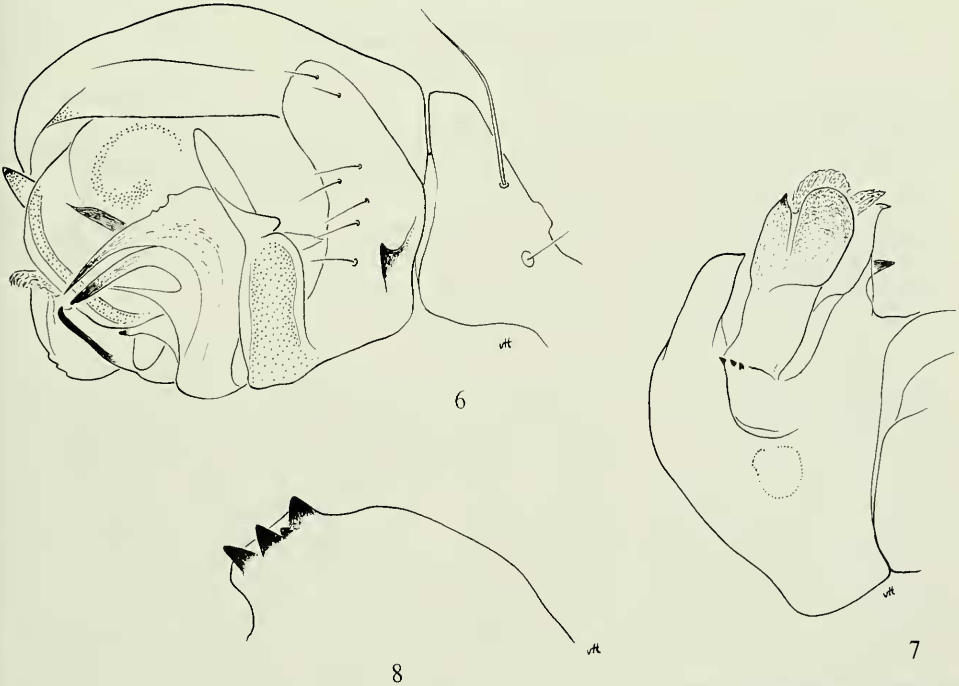

Fig. 6—8. *Lepthyphantes perseus* Van Helsdingen, spec. nov. 6, male palp, lateral aspect; 7, radical section, ventral aspect; 8, dentition on basal part of embolus, mesal aspect. 6, 7, X 200; 8, X 740

Coloration. Cephalothorax heavily suffused with grey, lateral margins and striae darkest. Chelicerae with dark grey streaks on dorsal and lateral surfaces, otherwise light brown. Sternum a shade darker, mouthparts with darker and lighter areas, as chelicerae. Legs light brown to yellow-brown, not annulated; palpal segments, the cymbium included, with strong, dark grey suffusion. Abdomen with the usual faint male pattern of cross-bars of blackish grey colour, intervening areas lighter grey with some white blotches (blotches absent in one paratype); ventral and ventro-lateral surfaces dark grey.

Chelicerae with three dorsal teeth. Stridulating files fine, as in *mengei* (Fig. 69).

Chaetotaxy of legs not differing from the generic pattern. Position of đ-spine on tibia I 0.31—0.36, length of this spine 0.26—0.29 mm. Tm I 0.17—0.22.

Male palp (Fig. 6—8). Paracymbium with a single, rather obtuse, strong tooth on the posterior margin of the proximal branch. Lamella with two equally long branches, the dorsal one very gradually tapering to a slender tip, the ventral one slightly less slender and shallowly forked at its tip (when viewed from dorsal or ventral side); as in *mengei*, there is a "dorsal lobe" with a serrate margin at the point where the element curves in anterior direction. Terminal apophysis with a tongue-shaped projection which is shorter and relatively broader than in *mengei*. Basal part of embolus with three or four denticles on a projecting mesal ridge. Length of cymbium 0.27—0.29 mm.

The species is only known from the type-locality, where it was collected in a beech forest, probably in leaf-litter.

Lepthyphantes flavipes (Blackwall)
(Fig. 9—12, 56)

Linyphia flavipes Blackwall, 1854: 178 (descr. ♂; England).

Lepthyphantes flavipes; Miller, 1947: 40, Pl. 13 Fig. 2 (♀). Locket & Millidge, 1953: 388, Fig. 231 B, D, F, 232 F (♀♂). Wiehle, 1956: 205, Fig. 344—346 (♀♂). Wanless, 1971: 23, 26, Pl. 3, Pl. 6 Fig. D (♀); 1973: 129, 134, Pl. 1 Fig. 5, Pl. 6 Fig. 5, Fig. 24B (♀).

Lepthyphantes tenebricola; Braun, 1960: 65 (misinterpretation of type-material of *Linyphia tenebricola* Wider signalized but again misinterpreted); 1969: 216 (idem). Braun & Rabeler, 1969: 44 (idem).

Lepthyphantes zimmermanni; Fage, 1931: 181 (cave record from Rumania).

Lepthyphantes mengei; Denis, 1952: 12 (cave record from Rumania).

Theridium henricae Six, 1858: 294 (descr. ♀♂; Netherlands).

Remarks. — To begin with the most disappointing discovery during our whole revisionary work in this species-group, we have to admit here that we are not convinced that figure 166 on plate 17 in Blackwall's "A History of the Spiders of Great Britain and Ireland" (part 2, 1864), where *Linyphia flavipes* Blackwall is depicted, male and female, is the same as what is now unanimously called *Lepthyphantes flavipes* (Blackwall). Especially the small figure of the male palp positively can not belong to this species. The original description of *Linyphia flavipes* by Blackwall (1854: 178) was not illustrated and the description does not help much. Original material is not available. We are not the first to suggest this discrepancy between the author's original intention and subsequent interpretation. Already Hull (1933: 106) pointed out that Blackwall's species had been misinterpreted. He also suggested (Hull & Harrison, 1937: 111) that *Linyphia flavipes*

Blackwall is the same as *Bathyphantes pullatus* (O. Pickard-Cambridge). He may be right, but we prefer to leave the case as it is, because stability is served best, at least in this case, by letting the matter rest. There is no end to *Lepthyphantes* nomenclature if we start the game of replacing well established names by others. Moreover, in most cases there is no solution to be offered with an acceptable degree of certainty.

Braun (1960) published a remark on the discrepancy between the type-material of *Linyphia tenebricola* Wider and *Lepthyphantes tenebricola* auct., though he can not be held responsible for the re-identification of the type-series. The identification of the original *tenebricola* specimens with *Lepthyphantes flavipes* (Blackwall), as stated there, was also incorrect. See also under remarks on *Lepthyphantes tenebricola* (Wider).

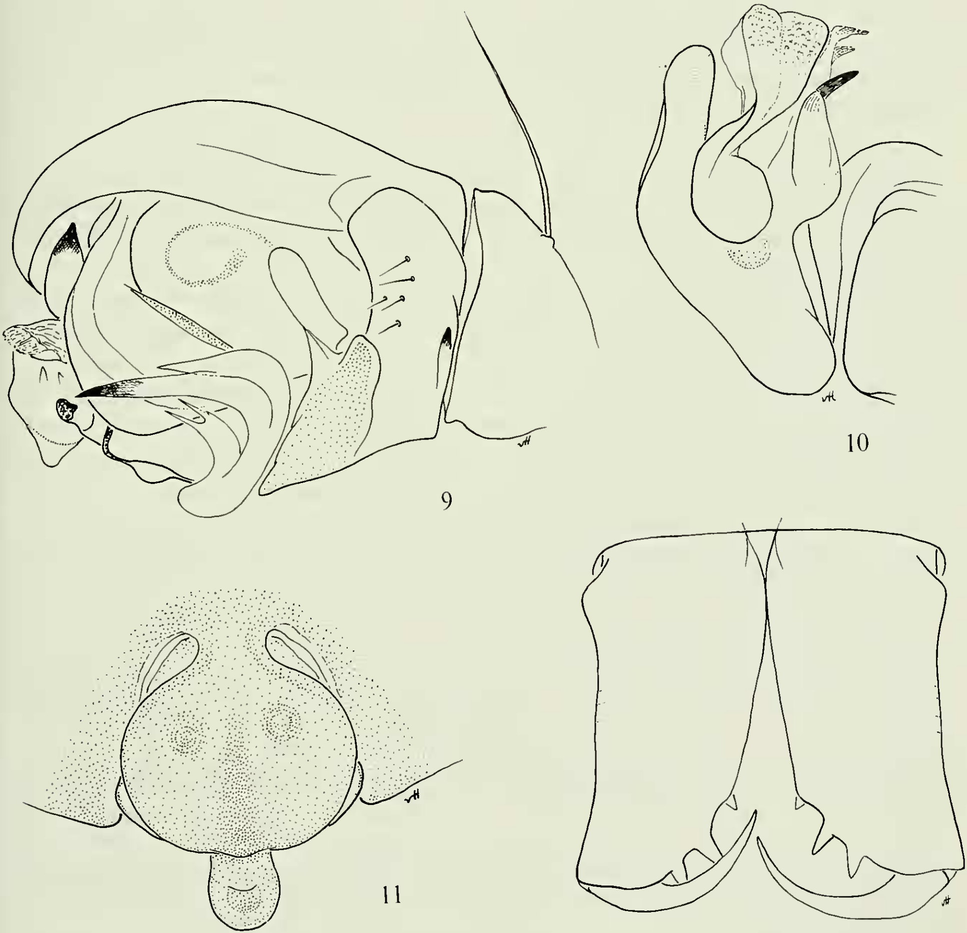

Fig. 9—12. *Lepthyphantes flavipes* (Blackwall). 9, male palp, lateral aspect; 10, radical section, ventral aspect; 11, epigyne; 12, male chelicerae, anterior aspect. 9, 10, X 200; 11, X 190; 12, X 142

The description of *Theridium henricae* by Six is very superficial and does not fit any particular Dutch species. Subsequently, the name was used, by Chyzer & Kulczyński (1894) for instance, for the species which in the British Isles was known as *Lepthyphantes flavipes* and, later again, recognized as its synonym. The question whether the name *T. henricae* was correctly applied to this species, is difficult to answer. In the Rijksmuseum van Natuurlijke Historie at Leiden there still exists a sample under this name in the Van Hasselt Collection. Van Hasselt (1885: 180) stated that he had received material of *T. henricae* from Six (type-material?), and that it was the same as *Lepthyphantes tenebricola.* (All other specimens, however, identified by him with *L. tenebricola* belong either to *Lepthyphantes tenuis* or to *L. zimmermanni*!). The sample of *T. henricae* consists of juveniles of a *Lepthyphantes* species, which indeed could be *L. flavipes,* but it is impossible to recognize the species with certainty. Besides, Chyzer & Kulczyński (1894: 69—70) maintain, that they examined two male specimens of "*Theridion Henricae*", identified by Six and kept in the collection of Thorell. From their remarks it becomes clear that this short series contained one specimen of *mengei* and one of *flavipes.*

Diagnosis. — *L. flavipes* is among the smallest species of the *tenuis* group. It is easily recognized by its coarse stridulating file (♀), the shape of the epigyne, and the cheliceral boss (♂). Most specimens are darkly pigmented, especially the chelicerae and the ♂ palp.

Measurements (in mm). Total length, ♀ 1.7—2.6, ♂ 1.7—2.2; length cephalothorax, ♀ 0.75—1.0, ♂ 0.77—0.90. Legs: Fe I 1.15—1.25 times length cephalothorax in ♀, 1.20—1.35 in ♂.

Stridulating files (Fig. 56) difficult to distinguish on the dark chelicerae (suffused with grey); widely separated ridges present in female, absent in male, or very indistinct and as widely separated as in female.[1]) Chelicerae of male (anterior aspect) with a latero-basal boss and concave outer surface (Fig. 12).

Male palp (Fig. 9, 10) characterized by the single, relatively sharp (cf. *mengei*) tooth on the posterior margin of the paracymbium, the shape of the lamella (with the terminal branches standing about perpendicular on the subterminal part), and the absence of denticles on the basal part of the embolus. The tooth on the paracymbium is situated slightly more to the dorsal side than in *mengei.* The terminal part of the embolus has a characteristic lobe-like extension on the latero-ventral side (lateral aspect). The basal segments of the palp are strongly suffused with grey, as are the chelicerae. Length of cymbium 0.27—0.30 mm.

Epigyne (Fig. 11) easily distinguished from that of the other species of this group by the characteristically rounded basal part of the scape. Posterior median plate hardly visible in the ventral aspect. There are two lateral depressions on the basal part of the scape, but these are often very slight and hardly visible. Width of scape 0.140—0.175 mm.

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[1]) This has already been pointed out in an earlier paper (Van Helsdingen, 1963: 36, Fig. 5, 6), but by mistake the figure of the male chelicerae (Fig. 6) was said to be the female, and vice-versa.

Distribution. — According to Bonnet, the species is restricted to Central Europe, including the British Isles; up to 1940 it was stated not to have been recorded from Scandinavia north of Denmark (see, however, remarks below), from Poland, the southern Balkans, or from Portugal. Since 1940 it has been found in southern Finland, Poland, the European U.S.S.R., and Italy (cave).

It has been mentioned from caves in Hungary (Boker, 1922; Kolosváry, 1928) Switzerland (Dresco, 1960, entrance), Italy (Brignoli, 1971), Spain (Fage, 1931), and also occurs in caves in Rumania (Fage, 1931: 181, sub *zimmermanni*; Denis, 1952: 12, sub *mengei*; both re-examined, MP). See also Wolf (1934—1937).

We have examined material from Austria (North Tirol, common), Czechoslovakia (Böhmen, common), Yugoslavia (Slowenia, Hercegovina), Rumania (material recorded by Niculescu, 1968), Italy (southern Alps, Parma, and Piemonte), Spain (Prov. Huesca, Rodellar, leg. E. Duffey), and Holland (common). The figures are based on specimens from Holland.

The following material has been re-examined: cave records from Spain by Fage (1931) from the provinces Tarragona and Soria (MP); cave records from Rumania by Denis (1952: 12, sub *mengei;* MP) and by Fage (1931: 181, sub *zimmermanni;* MP); identified material in the Muséum National d'Histoire Naturelle, Paris.

Through the kindness of Dr. T. Kronestedt of the Naturhistoriska Riksmuseet, Stockholm, a number of specimens could be examined, which are labelled "*Linyphia pygmaea* Sundevall" and are part of the Westring collection. Among the seven specimens examined, four were found to belong to *flavipes*. Westring's specimens are assumed to originate from Sweden, probably from the surroundings of Göteborg, and thus we may have found an early proof of the existence of *L. flavipes* in southern Sweden. It should be pointed out here that Chyzer & Kulczyński (1894: 70) were already aware of the existence of *L. flavipes* (*"L. Henricae"*) in Sweden. They reported to have seen specimens of this species in the collection of Thorell, partly under the name of *Linyphia pygmaea* (!). Bonnet appears to have overlooked this important remark.

Thus *L. flavipes* appears to be indeed a Central European species, reaching its northern limit in Great-Britain, Holland, Denmark, southern Sweden, southern Finland, Poland and the European U.S.S.R.¹) The upper limit in the Alps lies at about 1200 m; in the Apennines there is a record from 1650 m (Parma). The southern slopes of the Pyrenees, the Apennines, Slowenia, and Bulgaria form the southern limit of its distribution, apart from the Spanish cave records from Tarragona and Soria still more to the south.

It is a typical leaf-litter inhabiting species, in deciduous as well as coniferous forests. Adults throughout the whole year (Braun & Rabeler, 1969: 44, sub *tenebricola*).

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¹) There is a cryptic remark by Palmgren (1972: 91), who states to have found specimens of *Lepthyphantes zebrinus* (Menge) in southern Finland, suggesting at the same time that this probably is a geographical race (subspecies) of *Lepthyphantes flavipes*. This is the more surprising since Moritz (1968) redescribed *L. zebrinus* and demonstrated a number of apparent differences between the two species. In *zebrinus* the stridulating files are much finer, the epigyne has a medially excised scape, the paracymbium of the male palp is toothless and of quite different shape, and the lamella does not show any resemblance with that of *flavipes*. In our opinion *zebrinus* belongs to a different species-group.

Lepthyphantes herbicola Simon
(Fig. 13-15, 57)

Lepthyphantes herbicola Simon, 1884: 323, Fig. 92 (descr. ♀ ♂ ; France: Var, Alpes-Maritimes, Corse); 1929: 590, 595, Fig. 900-901 (♂ ♀, diagnosis), 733 (references). De Dalmas, 1922: 88 (France: Ile Giglio; cat.). Denis, 1933a: 572 (Pyrénées-Orientales); 1933b: 95 (Var); 1934: 152 (Var); 1935: 121 (Var); 1949: 18 (Provence).

Remarks. — It is not clear whether the original material of Simon is still extant. The species was described in 1884 from the Départements Var, Alpes-Maritimes and Corse. In the Paris Museum the available material from the time of Simon is labelled Marseille and Banyuls, while there is also one series without a locality label. A lectotype thus cannot be selected. There is no need for a neotype because the species is not easily confounded with any of its congeners.

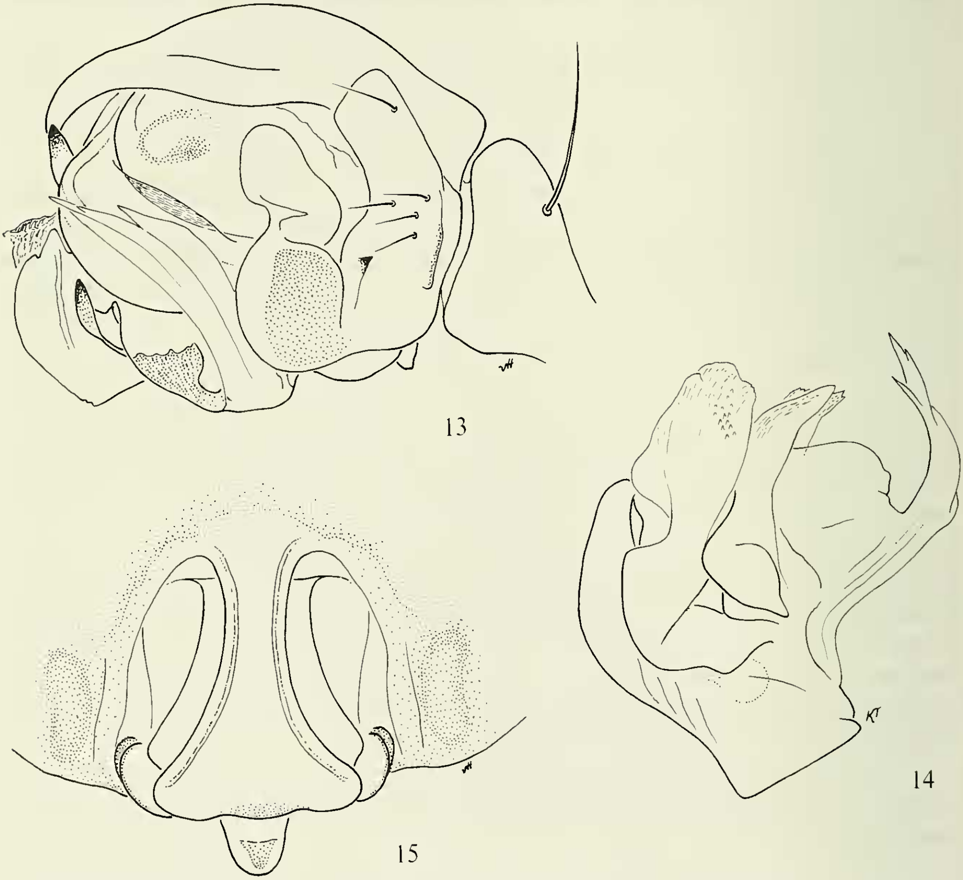

Fig. 13—15. *Lepthyphantes herbicola* Simon. 13, male palp, lateral aspect; 14, radical section, ventral aspect; 15, epigyne. 13, 15, X 200; 14, X 180

Diagnosis. — *L. herbicola* belongs to the smaller species of the group and is well characterized by its genitalia.

Measurements (mm). Total length, ♀ 1.8-2.3, ♂ 1.7-2.1; length cephalothorax,

♀ 0.77-0.92, ♂ 0.76-0.92. Legs: Fe I 1.1-1.3 times length cephalothorax in females, 1.15-1.30 times in males.

Stridulating files rather fine (Fig. 57), slightly coarser than in *mengei*.

Male palp (Fig. 13, 14) with only one small tooth on the paracymbium at the anterior margin of the proximal branch (in contradistinction to *mengei* and *flavipes*); the distal branch is much less slender than in the other species of the group and appears to be rather strongly pigmented. The lamella is only slightly curved and shows the usual dorsal and ventral arms. Embolus without denticles on basal part. Length of cymbium 0.29-0.33 mm.

Epigyne (Fig. 15). Scape with gradually widening basal part with concave margins; inner scape equally wide as basal part and also with concave margins; posterior median plate distinct in the ventral aspect. As the specimens themselves, the epigyne is small. Width of scape 0.125-0.150, of inner scape 0.125-0.140, of posterior median plate 0.160-0.190 mm.

Distribution. — Literature records all refer to southern France and Corse; on the mainland the species is restricted to the following provinces: Pyrénées-Orientales, Bouches-du-Rhône, Vaucluse, Var, Alpes-Maritimes, and Drôme. In 1934, Denis stated it to be not uncommon ("Assez fréquent, sous les pierres et dans les mousses") and Simon, too, indicates it to be common near Menton (1929). Other samples come from moss and litter in mixed or coniferous forest.

We have studied all available identified material in the collection of the Paris Museum (from Marseille, Banyuls, and an unlabelled series). New records can be given here from:

France: Ardèche, Planzolles W. of Joyeuse, 700 m, open pine forest, 18.vii.1974, P. J. van Helsdingen, 1♀ 1♂; W. of Joyeuse, mixed pine-chestnut forest, 7.vii.1974, P. J. van Helsdingen, 1♀ (both ML).

Italy: Naples, 1♀ 2♂, MP; Portici near Naples, 1♂, MP; Portici, 6♀, MP; Isola Ischia near Naples, 1♀ 1♂, Mus. Bergamo.

Algeria: Edough, 5♀ 1♂, MP.

Spain: Prov. Huesca, Rodellar, 8.vi.1973, sifted from moss in gorge near Rio Mascùn, leg. E. Duffey and in his collection, 4♀ 2♂.

Yugoslavia: Dalmatia, Spilja Vranjaća, Kotlenice n. Split, 5.viii.1971, 1♂; Isl. Cres, Lipica jama, 1♀; both leg. C. Deeleman, ML.

All figures were made after specimens from Marseille.

Lepthyphantes tenuis (Blackwall)
(Fig. 16-18, 58)

Linyphia tenuis Blackwall, 1852: 18 (nom. nov. pro *Linyphia pusilla* Blackwall, preoccupied by *Linyphia pusilla* Sundevall [= *Microlinyphia pusilla* (Sundevall)]).

Lepthyphantes tenuis; Locket & Millidge, 1953: 385, Fig. 230 E, 232 A (♀ ♂). Wiehle, 1956: 197, Fig. 331-335 (♀ ♂). Wanless, 1971: 22, 26, Pl. 2 Fig. A, B, Pl. 6 Fig. A (♀); 1973: 129, 132, 134, Pl. 1 Fig. 1, Pl. 4 Fig. 7, Pl. 6 Fig. 1 (♀).

Lepthyphantes falteronensis Di Caporiacco, 1936: 350 (descr. ♀ ♂; Italy, Apennines). **Syn. nov.**

Lepthyphantes aspromontis Di Caporiacco, 1949: 133, Fig. p. 134 (descr. ♂; Italy). Alberti, 1967: 26 (type catal. Mus. Triest). **Syn. nov.**

Lepthyphantes sanfilippoi Di Caporiacco, 1950: 108, Fig. 2 (descr. ♂; Italy, Liguria, in cave). **Syn. nov.**
?Linyphia arctica Keyserling, 1886: 85, Pl. 14 Fig. 179 (descr. ♀; Sitka, Alaska).
Lepthyphantes zimmermanni; Fage, 1931: 181 (Portugal, cave).

Remarks. — The name *tenuis* was introduced by Blackwall as a replacement name for his *pusilla* in the genus *Linyphia*, which name had already been used in this genus as a primary combination by Sundevall. We have not located any original material of Blackwall's *Linyphia pusilla*.

The original material of *Lepthyphantes falteronensis* Di Caporiacco could be located in the collection of Di Caporiacco in the Museo Zoologico in Firenze (MZF). It consists of 2 ♂ from Falterona and 2 ♂ from Monte Acuto. Not all specimens are in good condition: from either locality one specimen lacks both palps, the second specimen from Monte Acuto has a left palp only, the material from Monte Falterona is accompanied by a loose palp. The only complete specimen (from Monte Falterona) is designated lectotype here. The type-locality, Monte Falterona, is situated ENE of Florence in the Apennines. The specimens were collected at 1650 m (Mt. Falterona) and 1428 m (Mt. Acuto), respectively.

The male holotype of *Lepthyphantes aspromontis* Di Caporiacco, described from Italy (Calabria, Aspromonte), could be examined through courtesy of Dr. G. Alberti of the Museo Civico di Storia Naturale at Trieste, where the type is preserved. It belongs to *L. tenuis* (Blackwall).

Of the original material of *Lepthyphantes sanfilippoi* Di Caporiacco only one specimen could be located. It is selected as the (male) lectotype here. It is preserved at the Museo Civico di Storia Naturale at Milano and could be examined through the kindness of Dr. C. Leonardi. It appears to belong to *Lepthyphantes tenuis* (Blackwall).

The original material of *Linyphia arctica* Keyserling (1 ♀ only?) could not be located at the AMNH, nor at the BM; it is probably lost. Our suggestion of a possible synonymy is mainly based on the small figure of the epigyne while measurements and other details given by Keyserling agree with *tenuis*.

Specimens from la Palma, Canary Islands, are said to be different from the normal form in the shape of the lamella, the dentition of the paracymbium, and the coloration (Schmidt, 1975b). We have not seen the specimens.

Diagnosis. — A comparatively light species of small size. The paracymbium has a very characteristic pair of denticles, the lamella is easily recognized by its shape, the scape of the epigyne has the shape of an anchor.

Measurements (in mm). Total length, ♀ 2.3-2.8, ♂ 1.95-2.4; length cephalothorax, ♀ 0.95-1.10, ♂ 0.82-1.02. Legs: Fe I 1.25-1.35 times length cephalothorax in females, 1.25-1.4 times in males.

Stridulating files rather coarse (Fig. 58).

Male palp (Fig. 17, 18) easily recognized by the dentition of the paracymbium and the rather blunt dorsal branch of the lamella. Paracymbium with a small and sharp denticle at the posterior margin and a second, barely larger and slightly more conical denticle at the anterior margin of the proximal branch; posterior denticle pointing outward and backward, more outward than in *zimmermanni*. Lamella relatively small, the dorsal branch ending well before ventral branch, with

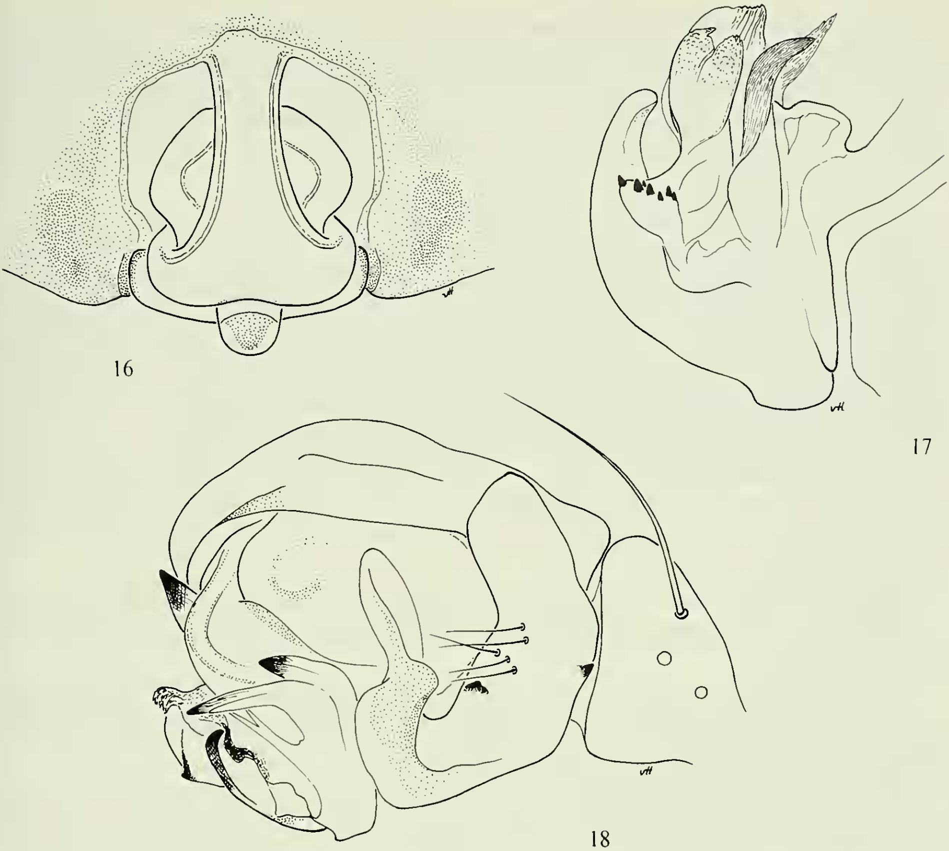

Fig. 16—18. *Lepthyphantes tenuis* (Blackwall). 16, epigyne; 17, radical section, ventral aspect; 18, male palp, lateral aspect. 16, X 194; 17, 18, X 180

obtuse tip; ventral branch slender and rather straight, sometimes forked at tip. Embolus with well-developed cluster of small teeth on basal part, numbering at least 7. Length of cymbium 0.29-0.34 mm.

Epigyne (Fig. 16) with a distinctly anchor-shaped scape; anterior section more or less parallel-sided or with concave margins, gradually diverging in posterior direction but not fluently passing into margins of broadest part of visible scape; inner scape with conspicuously rounded lateral lobes, about as wide as broadest point of exposed scape; posterior median plate hardly wider than scape. Width of scape 0.135-0.165, of inner scape 0.125-0.150, of posterior median plate 0.160-0.190 mm.

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¹) It has been suggested by Simon (1929: 733, footnote 2) that *Linyphia (Lepthyphantes) taczanowskii* O. P.-Cambridge, 1873 [misprinted *tarzanowskii*] would be close to *tenuis*. However, re-examination of the original material, which is still preserved in the collections of the Hope Department of Zoology (Entomology) at Oxford, revealed it to be a senior synonym [**syn. nov.**] of *Lepthyphantes trucidans* (L. Koch, 1879), described from the Yenissey region in Siberia. *Linyphia taczanowskii* was also collected in Siberia (Lake Baikal). *L. trucidans* does not fit in with the *tenuis* group.

Distribution. — For *Lepthyphantes tenuis,* Bonnet listed references for nearly all European countries with the exception of Iceland, Norway, Sweden and Finland. Russia and the Caucasus[1]) formed the eastern limit, Greece, Italy, Spain and Portugal the southern limit on the European mainland. Several records were available from the Açores, Madeira and New Zealand, but none from mediterranean North Africa.

Since 1940, this distribution was confirmed for many countries, while new countries could be added to it: Afghanistan (Denis, 1958) and Finland (Prov. Vaasa, 63°N, Hackman, 1951; Tvärminne, southern Finland, Palmgren, 1972, 1975). The occurrence of this species in the Canary Islands was established by Schmidt (1975 a, b), the occurrence on Madeira and the Açores was confirmed by Denis (1962 a and 1963, and 1964, respectively). Recently (Bragg & Leech, 1972) it has been recorded also from the Nearctic region (British Columbia, ♀ only), from where it probably had been recorded already by Keyserling (1886).

The species has been found in caves in Belgium (Leruth, 1935, 1939), France (Denis, 1959: Pyrenees), Portugal (Fage, 1931: sub *zimmermanni,* re-examined), Italy (Brignoli, 1971), and Bulgaria (Drensky, 1931; Deltshev, 1972 a, 1972 b, 1973). See also Wolf (1934-1937).

Samples have been re-examined from the Açores (Berland, 1932), New Zealand (De Dalmas, 1917), and Portugal (Fage, 1931: 181, *zimmermanni* 1♂, belongs to *tenuis*) (all MP).

Material has been found from the following countries, so that the known range can be extended to: Algeria (several series from Edough, Constantine and Sétif; MP), Lebanon (MP), Norway (Bergen; MP).

The diagnosis, measurements and figures are based on material from Holland (common), France (Menton), Czechoslovakia (not uncommon, lowland), Bulgaria (cave), and Italy (type-series of *L. falteronensis* and *L. aspromontis*). Specimens from Greece (Salonique, MP) and Spain (Prov. Huesca, Rodellar; BM) were also used.

With records from Madeira, the Canary Islands, Algeria, the Lebanon, and Afghanistan, *L. tenuis* reaches further south and south-east into warm, subtropical regions than most members of the *tenuis* group. It does not occur far to the north and appears to be rare there. In the Alps it is restricted to lower altitudes.

In New Zealand it must have been introduced. At least this is the only reasonable explanation for the extremely wide gap in the distribution. According to R. R. Forster (in litt.) it is extremely common in open country and in and around gardens in settled areas, but it does not occur in native forests. It also seems to be spreading to other islands in the south. For the Nearctic region an introduction is less self-evident. Recently 3 ♀ have been mentioned from W. Canada (Bragg & Leech, 1972, British Columbia), while we (vH) also received for examination a ♀ specimen from the State of Washington, through the kindness of Dr. Dondale, Ottawa. If *Linyphia arctica* Keyserling is indeed based on a specimen of *tenuis,* as suggested above, the species has been found also in southern Alaska (Sitka). Importation of spiders by man in the Nearctic Region is reported on by Lindroth (1957), on the east as well as on the west coast. However, we should be very careful with hasty conclusions.

L. tenuis does occur in the litter stratum in forests, but it is equally common in a wide variety of other habitats. In Holland it is, among other habitats, very common in tussocks of Marram grass on the seadunes. Adults throughout most of the year (Braun & Rabeler, 1969: 44).

Lepthyphantes tenebricoloides Schenkel
(Fig. 19-21, 59)

Lepthyphantes tenebricoloides Schenkel, 1938: 15, Fig. 5 a-e (descr. ♀ ♂ ; Madeira). Denis, 1941: 113 (Tenerife); 1962 a: 77 (Madeira). Forcart, 1961: 72 (catal.). Schmidt, 1975 a: 224 (Canary Islands; aberrant specimens?); 1975 b: 235 (Canary Islands).

Remarks. — The original description by Schenkel is lengthy and detailed and includes remarks on the variation in abdominal patterns. The original material should be at the Naturhistoriska Riksmuseet at Stockholm. We have only seen 3 ♀ and 3♂ paratypes from the Schenkel collection at Basel (not 2♀ and 4♂ as stated by Forcart, 1961: 72).

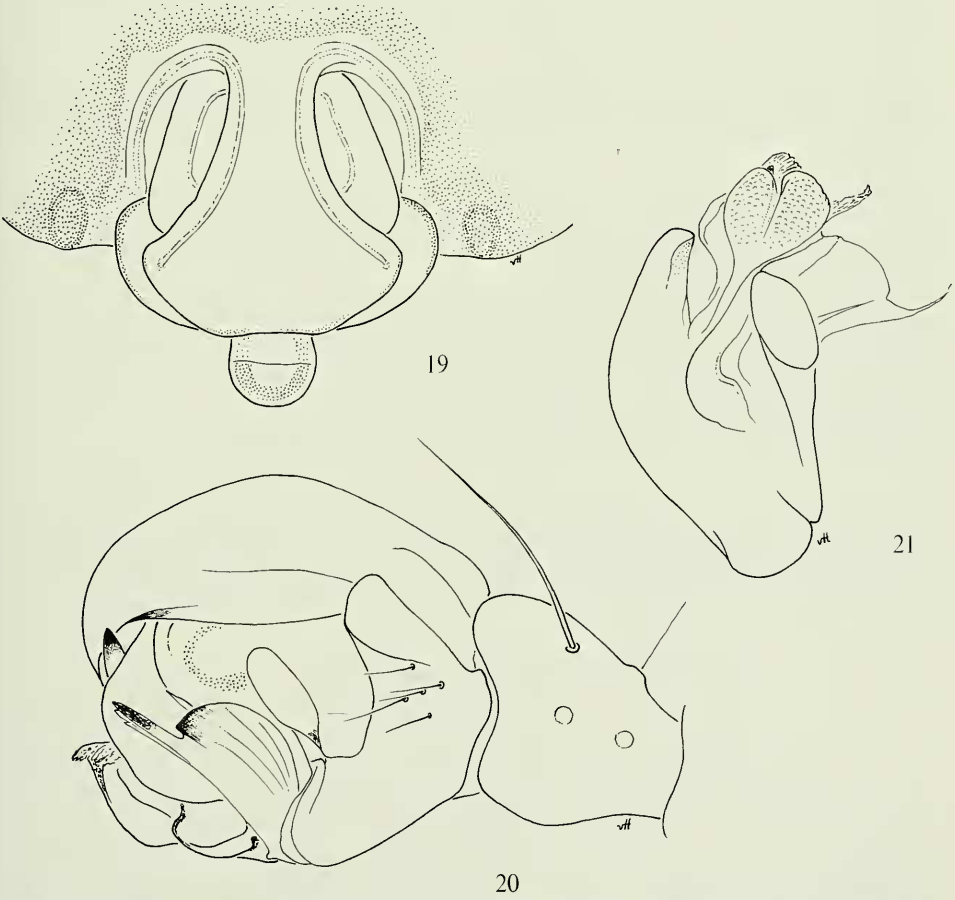


Fig. 19—21. *Lepthyphantes tenebricoloides* Schenkel. 19, epigyne; 20, male palp, lateral aspect; 21, radical section, ventral aspect. 19, X 190; 20, 21, X 160

According to Schmidt (1975 a), recently collected material from Gomera, Canary Islands, differs considerably from the description by Schenkel, especially as to the paracymbium. In the Madeira specimens the paracymbium is toothless; those from Gomera are said to show some dentition, but the position of the teeth is not indicated.

Diagnosis. — *L. tenebricoloides* is very light: the cephalothorax a very light yellow-brown with a narrow median dark grey streak that widens to the breadth of the eye-region in front; the abdomen gives a light impression and bears pairs of black spots dorsally, though the darker parts can be more pronounced in some specimens (see Schenkel's description and figures). On the ventral surface of the abdomen there are a pair of latero-ventral light spots halfway between the epigastric furrow and the spinnerets.

Measurements (in mm). Total length, ♀ 2.6-4.1, ♂ 2.6-3.0; length cephalothorax, ♀ 1.2-1.55 (Schenkel mentioned a female cephalothorax length of 1.7), ♂ 1.2-1.37. Legs: Fe I 1.1-1.2 times length cephalothorax in females, 1.2-1.35 times in males.

Stridulating files (Fig. 59) rather fine, conspicuous and well-developed in the males, less conspicuous in the females. Dorsal margin of chelicerae with three teeth as usual, but teeth long and slender, distinctly longer than in other species of this group.

Male palp (Fig. 20, 21). Paracymbium without any teeth. Lamella with a nearly straight ventral margin, the ventral branch projecting straight forward and slightly dorsal, the dorsal branch rounded-truncated. Base of embolus without denticles. Length of cymbium 0.35-0.39 mm.

Epigyne (Fig. 19) with basal part of scape gradually widening with concave margins towards broadest point; lateral lobes of inner scape as wide as basal part, their lateral margins about straight and converging in anterior direction; posterior median plate slightly wider than scape. Width of basal part of scape 0.150-0.200, of inner scape 0.160-0.175, of posterior median plate 0.185-0.225 mm.

Distribution. — *L. tenebricoloides* was described from Madeira. It has also been recorded from the Canary Islands (Denis, 1941). There are no records outside this archipelago. Recently again recorded from the Canary Islands (Schmidt, 1975 a, b), but the specimens are reported to disagree with the original description.

Lepthyphantes drenskyi Van Helsdingen, spec. nov.
(Fig. 22, 23, 60)

One sample of this new species was found in what is left of Drensky's collection in the Zoologisches Institut der Bulgarischen Akademie der Wissenschaften, Sofia; it had been identified (by Drensky?) with *L. tenebricola*. However, it appears to be different from *tenebricola* and rather reminds of *tenuis*, from wich it differs in the dentition of the paracymbium, the number of denticles on the embolus, and the stridulating files. There are no adult females in the sample.

Types. — ♂ holotype from Dragalewzi near Sofia, vi.1909, P. Drensky.

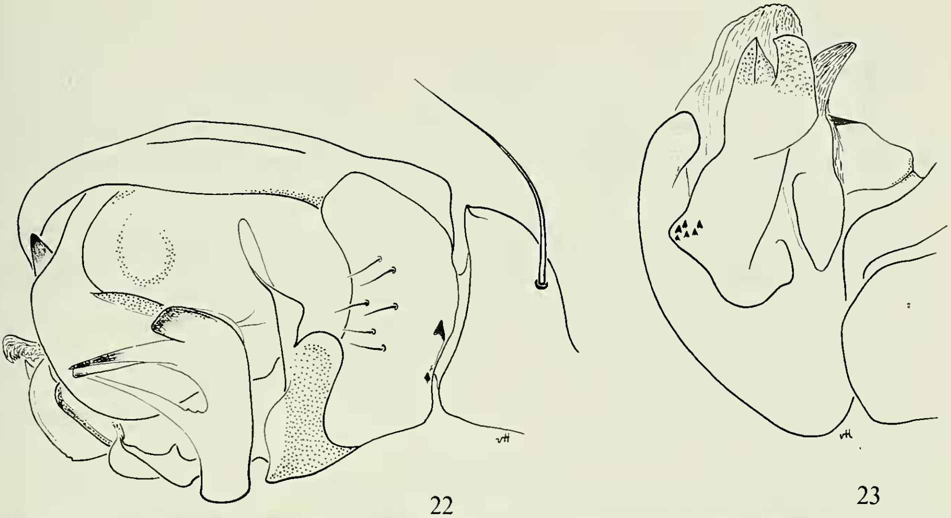


Fig. 22—23. *Lepthyphantes drenskyi* Van Helsdingen, spec. nov. 22, male palp, lateral aspect; 23, radical section, ventral aspect. X 142

Paratypes (1♂, 1 subadult ♂, 1 subadult ♀) from the same locality, preserved with the holotype. All specimens are in the Zoologisches Institut at Sofia.

Description. — Measurements (in mm). Male. Total length 2.2-2.4, length cephalothorax 0.95-1.05. Fe I 1.25-1.40 times length cephalothorax.

Coloration. The specimens are light yellow-brown (discoloured through preservation?). Dorsal pattern distinct, composed of greyish chevrons.

Chelicerae with coarse stridulating files (Fig. 60). Legs with the usual spines, position of the retrodorsal (basal) spine on tibia I 0.30-0.31, length of this spine 0.325 mm. Tm I 0.22. palp (Fig. 22, 23). Paracymbium with a single, small denticle at posterior margin. Embolus with four denticles on the protruding part of the basal half. Lamella not unlike that of *tenuis*, but the dorsal branch more truncate, blunt, not pointed. Length of cymbium 0.38-0.40 mm.

As indicated above, *L. drenskyi* is not unlike *tenuis*, but in that species the paracymbium bears a second tooth at the anterior margin of the proximal branch, the embolus has seven or more teeth, and the dorsal branch of the lamella is short, but distinctly pointed, not truncate. The stridulating files make a coarser appearance.

The species is named after Pentcho Drensky, as a late homage to this well-known Bulgarian arachnologist, who has contributed so much to our knowledge of the Bulgarian spider fauna, and who also collected the type-series.

Lepthyphantes zimmermanni Bertkau
(Fig. 24-27, 61)

Lepthyphantes zimmermanni Bertkau, 1890: 10 (nom. nov. pro *Lepthyphantes zebrinus* Simon, 1884). Locket & Millidge, 1953: 386, Fig. 230 B, C, 231 G, 232 B (♀ ♂). Wiehle, 1956: 200, Fig. 336-339 (♀ ♂). Wanless, 1971: 22, 26, Pl. 2, Pl. 6 Fig. B (♀); 1973: 129, 134, Pl. 1 Fig. 4, Pl. 6 Fig. 4 (♀).

Lepthyphantes borealis Braendegård, 1932: 12, Fig. 2 (descr. ♀; Iceland); 1958: 84, 85 (= variety of *zimmermanni*).
Lepthyphantes cristatus; Simon, 1892: clxxvii (Iceland).

Remarks. — Simon (1929: 595) described a variety *spiniger* from Southern France, which subsequently has been recognized as a separate species (Dresco & Jézéquel, 1961). It is treated as such in this paper.

Diagnosis. — The male of this species is well characterized, apart from the shape of the lamella, by the peculiar small and sharp backward pointing denticle

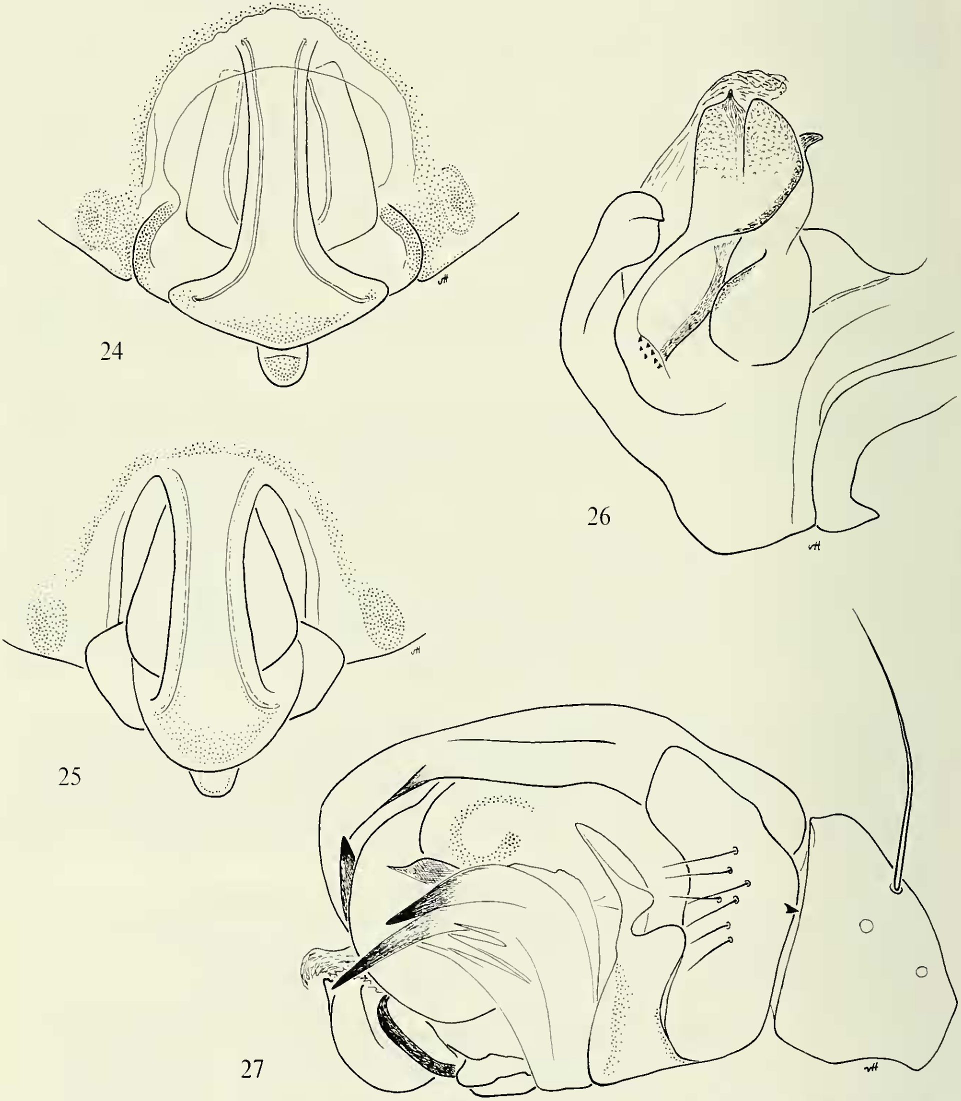


Fig. 24—27. *Lepthyphantes zimmermanni* Bertkau. 24, epigyne (specimen from Holland); 25, epigyne (specimen from Bulgaria); 26, radical section, ventral aspect; 27, male palp, lateral aspect. 24, X 165; 26, 27, X 160; 25, X 142

on the posterior margin of the paracymbium. The epigyne is much like that of *L. floriana,* but there are differences in the shape of the scape and the laterally protruding wings of the underlying arched part of the latter species.

Measurements (in mm). Total length, ♀ 2.2-3.1, ♂ 2.2-2.75; length cephalothorax, ♀ 0.95-1.25, ♂ 1.0-1.25. Legs: Fe I 1.2-1.4 times length cephalothorax in females, 1.15-1.35 times in males.

Stridulating files (Fig. 61) coarse at base to rather fine toward apex, well-developed, slightly coarser than in *floriana* from Rumania.

Male palp (fig. 26, 27) characterized by the single small but sharp tooth near the posterior margin of the paracymbium, which points backward rather than outward. Lamella evenly curved, with a distinct separate dorsal branch and a much longer ventral branch, the latter slender and tapering to a sharp tip. Base of embolus on ventral side with seven denticles (cf. *spiniger*). Length of cymbium 0.37-0.43 mm.

Epigyne (Fig. 24) with a long and slender anterior section of basal part of scape, parallel-sided, rather suddenly widening into the much broader posterior section; lateral wings of inner scape rather angular, margins in front of projecting angle rather straight; inner scape as wide as basal part; posterior median plate distinctly wider than scape (shape of median plate much depending on angle of vision). Width of basal part of scape 0.150-0.175, of inner scape 0.150-0.175, of posterior median plate in ventral view 0.210-0.250 mm.

Morphological variation. A slightly aberrant specimen from Bulgaria (♀, Fig. 25) is tentatively placed here, though the ventral aspect of the scape is obviously different; also the posterior aspect reveals a swollen ventral surface of the basal part of the scape, while this part is much flatter in *zimmermanni.* It is unfortunate that we do not have any *zimmermanni* male from Bulgaria, or a good sample of this type of female with matching males.

Distribution. — The records up to 1940, as given by Bonnet, cover most of Europe, including the British Isles but with the exception of Norway, Sweden and Finland, Poland and more to the east. There are, however, records from the Faroers, and also from Iceland, where it seems well-established (Braendegård, 1958: 85). In Southern Europe there are records from Portugal (Fage, 1931: 181: = *tenuis,* re-examined), from Spain (Galiano, 1910, sub *zebrinus,* citing a record by Simon; Denis, 1938; Fage, 1931, cave record, re-examined), and from Italy (several authors). The Balkans and Hungary formed the eastern boundary in 1940. The original description of *Bathyphantes pygmaeus* Menge is considered by some authors to refer, at least partly, to *zimmermanni*; in that case Poland (Danzig) falls within the distribution of the species as known up to 1940.

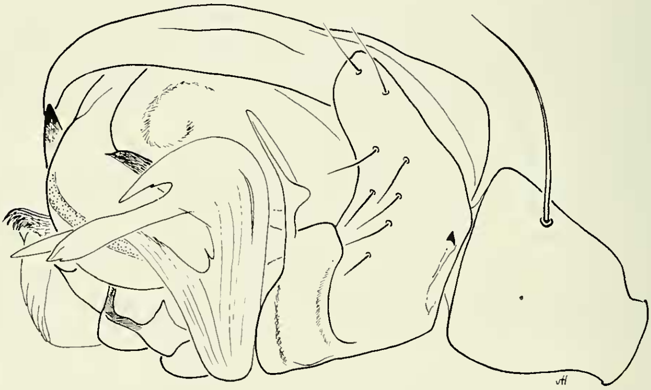
Since 1940, there are new records, among others, from Poland, European U.S.S.R., Bulgaria, Finland and Ireland. There is one record from northern Yugoslavia (Polenec, 1958).

Cave records come from Belgium (Leruth, 1935, 1939), France (Fage, 1931, re-examined; Denis, 1959, Pyrenees; Denis, 1967, Haute-Garonne), from Spain (Fage, 1931, re-examined), Bulgaria (Deltshev, 1972 a, 1972 b, and 1973; specimen re-examined and identification maintained, despite observed differences (Fig. 25)).

The cave records from Portugal (Fage, 1931: 181, = *tenuis*, re-examined) were based on misidentifications. See also Wolf (1934-1937).

We have examined a fair number of specimens from Switzerland (coll. Schenkel) and France (coll. Simon). A specimen in the collection of Simon, originating from Iceland and identified with *L. cristatus* (Menge) (Simon, 1892 ?), was found to belong to *zimmermanni*. Other examined material came from Czechoslovakia (one locality only), Bulgaria (1 ♀ only, in cave), and Holland. In Tirol and eastern Switzerland it seems to be lacking. The distribution in the Balkans is hardly known. We presume *zimmermanni* to be absent from higher mountainous regions. Our figures are based on specimens from Holland.

L. zimmermanni is found in the litter stratum of preferably coniferous forest (Braun & Rabeler, 1969: 44).



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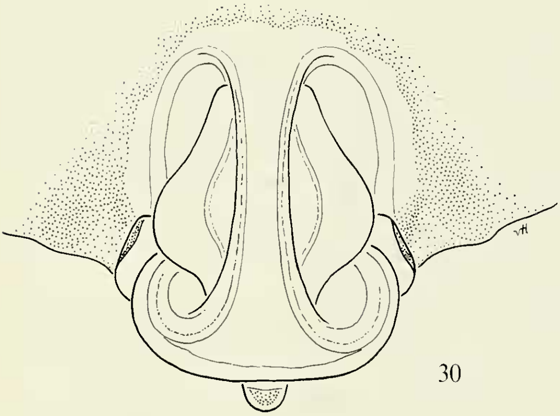

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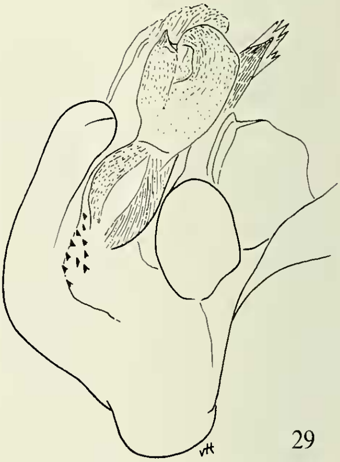

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Fig. 28—30. *Lepthyphantes spiniger* Simon. 28, male palp, lateral aspect; 29, radical section, ventral aspect; 30, epigyne. 28, 29, X 160; 30, X 200

Lepthyphantes spiniger Simon
(Fig. 28-30, 62)

Lepthyphantes zimmermanni spiniger Simon, 1929: 595 (descr.; Pyrenees and Alps), 733 (reference). Fage, 1931: 181, 237 (France: cave in Ariège). Dresco, 1949: 187 (France: Pyrénées-Centrales). Denis, 1957: 254 (Pyrénées).

Lepthyphantes spiniger; Dresco & Jézéquel, 1961: 105, Fig. 1-4 (descr. ♂ ♀, distinct species; Basses-Pyrénées, Hautes-Pyrénées, Haute-Garonne).

Remarks. — The collection of the Muséum National d'Histoire Naturelle at Paris contains a number of samples of this species, but it is not clear which of these belongs to the material on which Simon based his diagnostic remarks. All samples contained specimens of other species as well. Still we do not think it necessary to select a lectotype, because the species is quite characteristic and can hardly be confounded with any of the group members.

Diagnosis. — *L. spiniger* is most easily distinguished from its congeners by the spinose metatarsi and the very fine stridulating files of the chelicerae.

Measurements (mm). Total length, ♀ 2.7-3.2, ♂ 2.1-2.7; length cephalothorax, ♀ 1.10-1.27, ♂ 1.10-1.20. Legs: Fe I 1.15-1.3 times length cephalothorax in females, 1.25-1.45 times in males.

Stridulating files (Fig. 62) very fine in both sexes. Metatarsi with a l'- and l''-spine beside the usual dorsal spine, but metatarsus III not always bearing a complete set.

Male palp (Fig. 28, 29) characterized by the large lamella, which has the longer terminal branch forked, and by the large number of denticles (11) on the basal part of the embolus. The paracymbium bears a single small tooth, which does not point backward as in *zimmermanni* but dorsad, while below it a ridge-like excrescence is found along the posterior margin. Length of cymbium 0.36-0.41 mm.

Epigyne (Fig. 30) resembling that of *zimmermanni,* but posterior section of basal part of scape more clearly showing the reversal of its course, the lateral margins distinctly curving anterad; lateral wings of inner scape wide and broadly rounded; entire scape slightly more protruding posterad. Posterior median plate less visible than in *zimmermanni.* Width of basal part of scape 0.150-0.190, of inner scape (measured between apices of wings) 0.160-0.175, of posterior median plate 0.185-0.225 mm.

Distribution. — The species, according to Simon, 1929 (p. 733), occurs in coniferous forests in the Pyrenees and the Alps. Actually this can only be confirmed for the Pyrenees. We have examined all available material at the Muséum National d'Histoire Naturelle at Paris, which came from Bagnères-de-Bigorre (Hautes-Pyrénées), from the "Basses-Pyrénées", from the Grotte d'Aubert (Ariège: Moulis), and from the Grotte de Lestelas (Ariège: St. Lizier) (Fage, 1931). Apart from Simon's reference to the Alps, all other authors gave records from the Pyrenees only. Of four tubes in the Paris Museum the labels bear only numbers, which appear to be of no help in establishing the origin of the material. These samples might indeed come from the Alps, but we should like to have confirmed the occurrence in this region by fresh and well-localized captures.

Nearly all samples referred to above were a mixture of *spiniger* and *zimmermanni,* in several cases mixed up with other *Lepthyphantes* species as well.

The species was collected in the entrances of caves and in dolines, but also outside caves in the litter stratum of coniferous forests.

Lepthyphantes floriana Van Helsdingen, spec. nov.
(Fig. 31-34, 63)

Lepthyphantes zimmermanni; Niculescu-Burlacu, 1968: 91 (Rumania).

Types. — Holotype ♂ from Branesti, near Bucarest, Rumania (ML); many ♀ and ♂ paratypes from the same locality (ML and Institutul de Biologie "Traian Savulescu" at Bucarest).

Specimens of this species were doubtfully referred to *L. zimmermanni* by one of us (vH) when he advised Miss Burlacu in 1967 during her faunistic research in the Branesti wood near Bucarest. In the course of our present review we realized that a set of constant differential characters neatly separates this population from *zimmermanni* and the other species of this group, and that we are dealing with a separate species of the *zimmermanni* subgroup. It is a pleasure to name this species after Mrs. Floriana Niculescu-Burlacu.

Diagnosis. — A species of the *tenuis* group, which closely resembles *zimmermanni* but differs in the dentition of the paracymbium, having two teeth instead of one; the shape of the lamella is also different. The lateral wings of the inner scape in the epigyne are of more angular shape than in *zimmermanni* and *spiniger.* The stridulating files (Fig. 63) are finer, with the ridges closer together than in *zimmermanni,* but not as fine as in *spiniger.* The legs, especially the femora, are conspicuously whitish yellow.

Measurements (mm). Total length, ♀ 2.5-2.7, ♂ 2.0-2.6; length cephalothorax, ♀ ♂ 1.0-1.1. Legs: Fe I 1.15-1.3 times length cephalothorax in females, 1.2-1.3 times in males.

Male palp (Fig. 31-33) with the paracymbium furnished with two teeth at the posterior margin, the upper one pointing downward, the lower one slightly larger and pointing upward, thus enclosing a roundish dent between them. Lamella with a dorsal lobe above the main lateral branch, dorsal and ventral branches after the curve rather short. Base of embolus with few denticles or none, this character being variable. Length of cymbium 0.40-0.44 mm.

Epigyne (Fig. 34) hardly differing from that of *zimmermanni,* but the wing-like extensions of the inner scape with a distinct posterior angle and often with an additional projection just in front of broadest point, giving the wings an angular appearance. Posterior median plate largely covered by the wings of the inner scape and thus less conspicuous than in *zimmermanni.* Width of basal part of scape 0.175-0.190, of inner scape (measured between tips of wings) 0.185-0.200, of posterior median plate 0.210-0.240 mm.

Distribution. — *L. floriana* is described after specimens from Branesti forest near Bucarest, Rumania, where it appears to be very common. The specimens were collected with Barber traps and inhabit the leaflitter stratum of deciduous forest.

A single ♀ specimen from Drensky's collection (Zoological Institute, Sofia) seems to belong to this species; it originates from Tscherepischki monastir near Iskar, Bulgaria, vi.1916, leg. P. Drensky, which suggests a wider distribution in the Balkans.

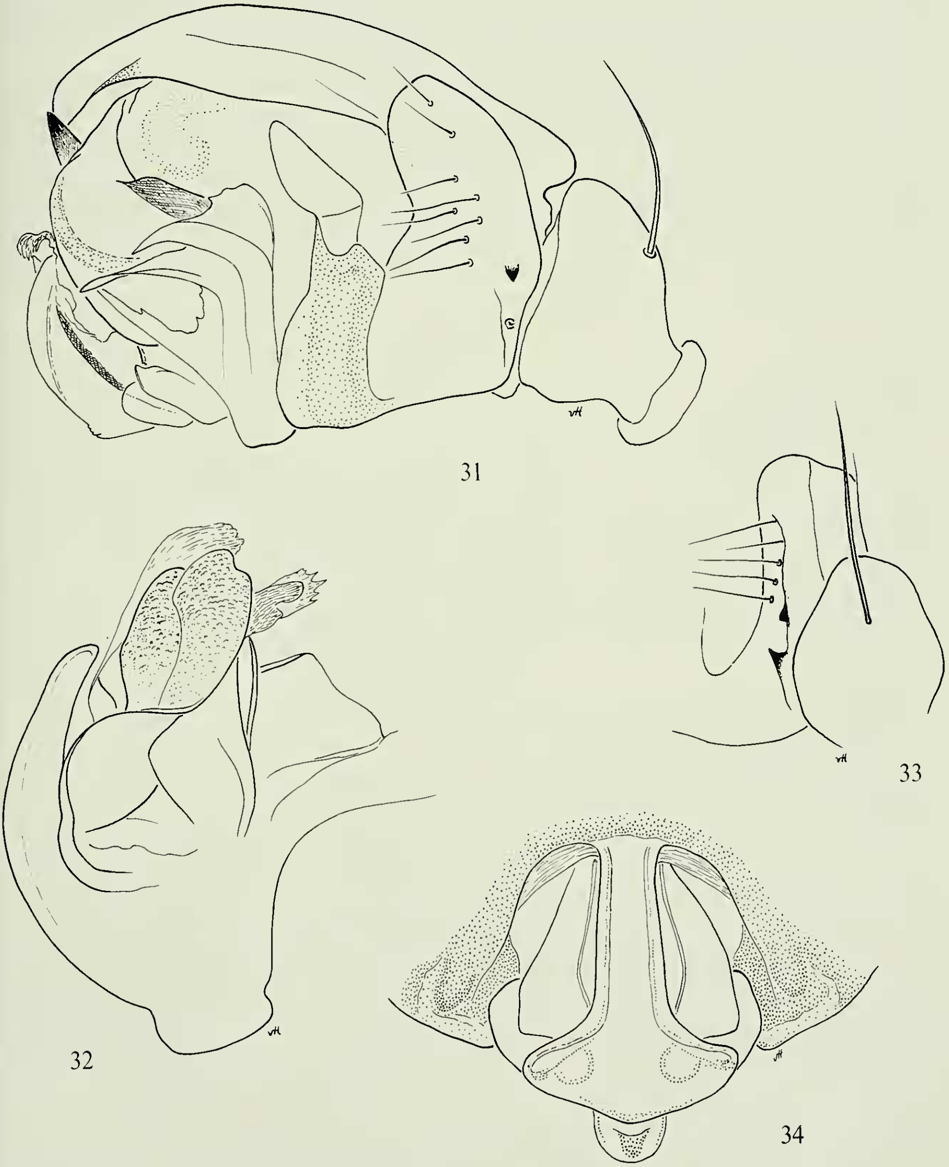


Fig. 31—34. *Lepthyphantes floriana* Van Helsdingen, spec. nov. 31, male palp, lateral aspect; 32, radical section, ventral aspect; 33, paracymbium; 34, epigyne. 33, X 142; 34, X 150; 31, 32, X 160

Lepthyphantes tenebricola (Wider)
(Fig. 35-38, 64)

Linyphia tenebricola Wider, 1834: 267, Pl. 18 Fig. 2 (descr. ♀; Germany).

Lepthyphantes tenebricola; Miller, 1947: 40, Pl. 13 Fig. 3 (♀). Locket & Millidge, 1953: 388, Fig. 230 D, 232 G (♀ ♂). Wiehle, 1956: 145, Fig. 327-330 (♀ ♂). Wanless, 1971: 23, 26, Pl. 3, Pl. 6 Fig. C (♀); 1973: 129, 134, Pl. 1 Fig. 2, Pl. 6 Fig. 2 (♀).

Linyphia arcuata Thorell, 1856: 168 (descr. ♀ ♂; Sweden).

Lepthyphantes arcuatus; Braun, 1960: 65 (used as oldest available synonym because the type-material of *Linyphia tenebricola* Wider was found to belong to another species; see, however, under remarks below); 1969: 215 (idem). Braun & Rabeler, 1969: 41 (idem).

Remarks. — Braun (1960), having been informed that the type-series of *Linyphia tenebricola* Wider (in SMF) did not belong to the species currently recognized under that name (in the combination *Lepthyphantes tenebricola*), but to *Lepthyphantes flavipes* (Blackwall), solved the problem by replacing *flavipes* Blackwall (from 1854) by the older *tenebricola* Wider (from 1834). *Lepthyphantes tenebricola* auct. consequently had to be replaced by the oldest available synonym, *Linyphia*

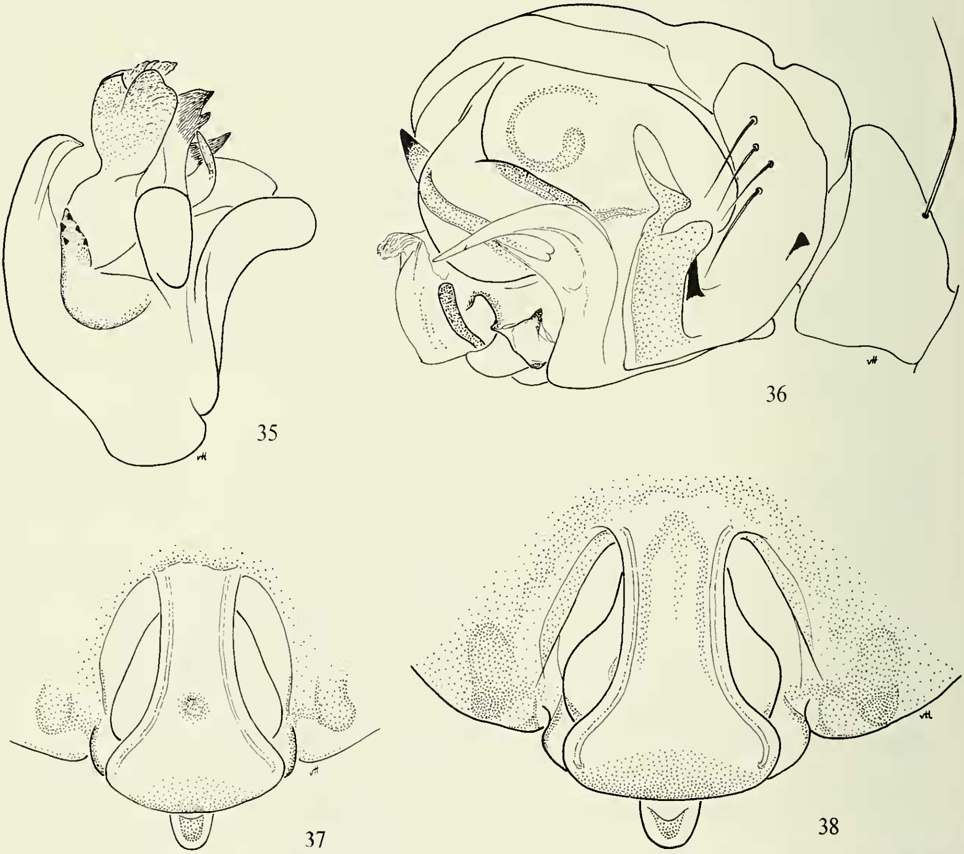


Fig. 35—38. *Lepthyphantes tenebricola* (Wider). 35, radical section, ventral aspect; 36, male palp, lateral aspect; 37, epigyne (specimen from French Jura); 38, epigyne (specimen from Holland). 37, X 135; 35, 36, X 144; 38, X 158

arcuata Thorell, 1856. Subsequently it was found that the one misidentification had been replaced by another (Locket, Millidge & Van Helsdingen, 1970: 90), as the type-specimens were found to belong to *Lepthyphantes mengei* Kulczyński, 1887, and not to *L. flavipes* (Blackwall). Straightforward nomenclatorial procedures would ask for another shifting of names, replacing *mengei* Kulczyński (from 1887) by *tenebricola* Wider (from 1834), using *arcuatus* Thorell (from 1856) for *tenebricola* auct., and re-establishing *flavipes* Blackwall in its original sense. However, it is thought highly unadvisable to carry through such a shifting of names for so common and frequently used names — not only by taxonomists. A proposal to stabilize the situation has therefore been presented to the International Commission on Zoological Nomenclature (see Locket, Millidge & Van Helsdingen, 1970). We deal with the species in the current sense here.

The synonymy of *Linyphia arcuata* Thorell with the species currently referred to as *Lepthyphantes tenebricola* (Wider) is difficult to ascertain, unambiguous type-material of *arcuata* not being available.

Diagnosis. — The species is easily recognized by the dentition of the paracymbium and the relatively simple lamella. The epigyne has a comparatively broad basal portion of the visible scape.

Measurements (in mm). Total length, ♀ 2.2-2.8, ♂ 2.15-2.35; length cephalothorax, ♀ 0.92-1.12, ♂ 0.97-1.05. Legs: Fe I 1.1-1.2 times cephalothorax in females, 1.1-1.25 times in males.

Stridulating files (Fig. 64) coarse at base, finer at apex.

Male palp (Fig. 35, 36): paracymbium with two teeth on the basal branch, viz., a blunt one near the posterior margin and a long and slender one behind the distal branch when seen from the side, but revealed in full length when viewed slightly from behind. Lamella sickle-shaped, its outer (dorsal) curve with or without an additional branch, of comparatively simple shape. Base of embolus with 3 to 7 denticles. Length of cymbium 0.36-0.39 mm.

The variation observed in the palp of *tenebricola* concerns the size of the large, distal tooth on the paracymbium, the shape of the lamella, and the number of denticles on the base of the embolus. As to the lamella, it has already been pointed out above that the outer margin may have a separate short branch dorsally, otherwise this branch is only indicated by a small denticle. The number of denticles on the basal section of the embolus varies from three to seven.

Epigyne (Fig. 38) with basal part of scape gradually widening from the relatively broad anterior section (two-fifths to one-half of maximum width of scape) to the broadly rounded posterior margin where the scape turns dorsad and inward; at this point the scape is conspicuously dark brown, a sign of heavy sclerotization, distinguishing it at once from most other species recognized so far; lateral wings of inner scape with tips as far apart as width of basal part of scape or slightly less, and rounded, never angular. Posterior median plate visible at either side of scape, but not very conspicuously so. Width of basal part of scape 0.175-0.215, of inner scape 0.150-0.190, of posterior median plate 0.200-0.240 mm.

The epigyne quite obviously is subject to a relatively large variation. Not only the ratio width anterior section to width posterior section of the basal part of the scape varies between 0.4 and 0.5 (which makes quite a different impression), but there also is a large amount of variation in the development of a median pit or depression at half length of the basal part of the scape. This pit can be quite conspicuous because of the stronger pigmentation (sclerotization) of the surrounding area (rare), or it merely consists of a slight depression with only the slightest pigmentation. We have seen well pitted scapes in specimens from the French Jura (Fig. 37) and from Graubünden in Switzerland. The lateral wings of the inner scape are rounded with a straight or slightly concave margin in front of the broadest point.

Distribution. — Bonnet could list references for nearly the whole of Europe, with the exception of Iceland and Greece. Moreover, the species had been found on the Açores, Madeira, and in Kamtchatka.

Since 1940, the species has again been recorded from many countries in Europe. The only record from Madeira (Simon, 1897), based on a single adult female (MP, examined), was already disputed by Denis (1962: 77, 108) and is here referred to *tenuis*. We have not seen the specimens from the Açores. The material from Kamtchatka certainly needs to be re-examined.

The species is said to occur also in caves (records from Switzerland and Hungary, see Wolf, 1934-1937). It is certainly not a troglophilous species and may have been found near the entrances only.

Our observations are based on material from Austria (common), Czechoslovakia (common), Switzerland (common), Italy, Bulgaria and Holland (infrequent). Figures based on specimens from Holland. It is a widespread species and usually referred to as not uncommon in the leaf-litter stratum in forests. It is common in the Swiss and Austrian Alps (up to 2,000 m). Most adult specimens were collected in the summer (Braun & Rabeler, 1969: 41, sub *arcuatus*; Palmgren, 1975: 59).

Lepthyphantes jacksoni Schenkel
(Fig. 39-42, 65)

Lepthyphantes jacksoni Schenkel, 1925: 266, 302, Fig. 10 A-D (descr. ♀ ♂ ; Wallis, Switzerland); 1927: 229 (Wallis); 1929: 10 (Tessin); 1933: 15 (Wallis). Forcart, 1961: 72 (designation of lectotype).
Lepthyphantes tenebricola; Schenkel, 1929: 10 (p.p.; Tessin).

Types. — The original material of this species is preserved in the Basel collection, together with that of later records. A male, bearing the label "Weg vom Hotel zum Märjelensee" was selected lectotype by Forcart (1961). A female from "Weg vom Hotel Jungfrau zum Eggishorn" is the only paralectotype.

Diagnosis. — *L. jacksoni* belongs to the species-subgroup with a pit or depression in the scape of the epigyne and a single large tooth on the paracymbium. It can be distinguished from the other member of the subgroup in the Alps by the shape of the lamella which has the two branches clearly diverging; in *jacksonoides* the branches run parallel.

Measurements (in mm). Total length, ♀ 2.2-2.5, ♂ 1.95-2.2; length cephalothorax, ♀ 0.96-1.08, ♂ 0.90-1.08. Legs: Fe I 1.15-1.25 times length cephalothorax in females, 1.1-1.2 times in males.

Stridulating files rather coarse (Fig. 65).

Male palp (Fig. 39-41). Paracymbium with a single, fair-sized tooth close to the inner margin of the distal branch and thus not visible in the lateral aspect, but quite conspicuous in postero-lateral view. Lamella forked, both branches well-developed, diverging (cf. *jacksonoides*), dorsal branch pointing forward, ventral branch longest and curved antero-ventrally. Terminal apophysis with a well-developed and sclerotized ventral lobe, which is blade-like and curved upward. Base of embolus with 1-4 denticles. Length of cymbium 0.42-0.45 mm.

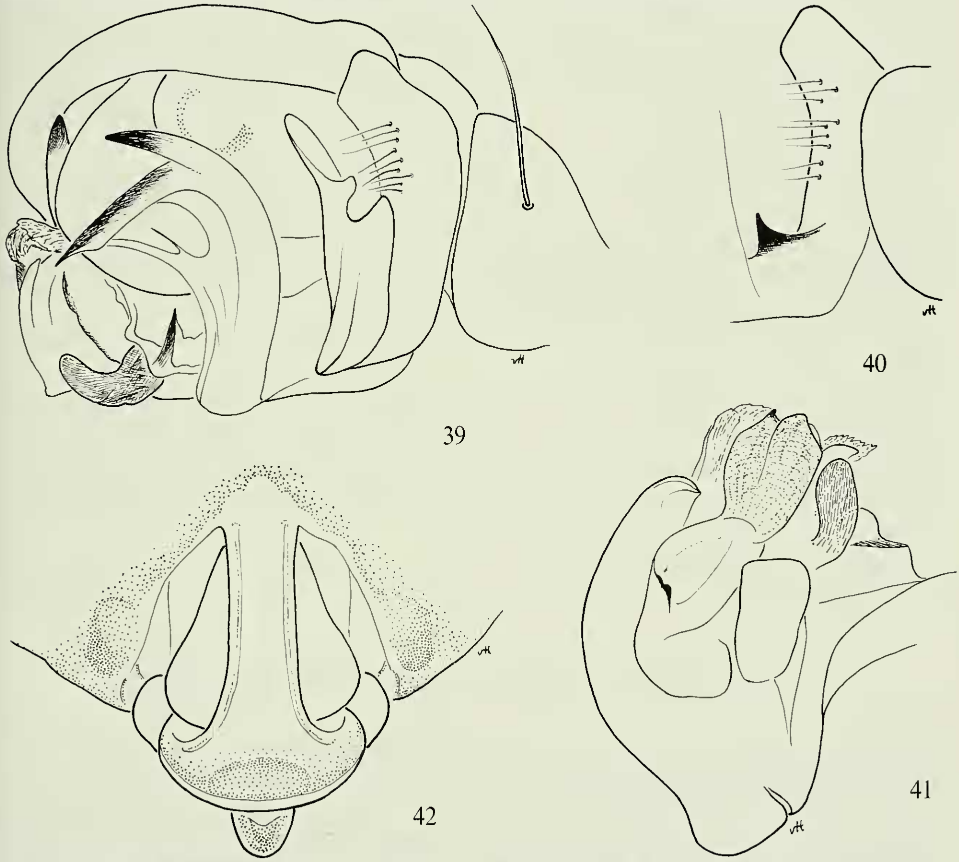


Fig. 39—42. *Lepthyphantes jacksoni* Schenkel. 39, male palp, lateral aspect; 40, paracymbium; 41, radical section, ventral aspect; 42, epigyne. X 142

Epigyne (Fig. 42). Basal part of scape with parallel-sided stem, widening into the much broader posterior section which bears a characteristic, oval depression just in front of the transition of basal part into inner scape; lateral wings of inner scape rounded or slightly angular, inner scape at this point nearly as wide as broadest, posterior section of basal part. Posterior median plate distinctly wider than scape. Width of basal part of scape 0.200-0.215, of inner scape 0.185-0.190, of posterior median plate 0.250 mm. In the lateral aspect the strong curvature of the basal part of the scape and the depression near the tip are distinct.

Distribution. — Up to the present the species had only been recorded by Schenkel from Wallis and Tessin in Switzerland. All Schenkel's specimens (see below) were collected in July and August, and above 2,000 m, but the number of records is too scanty yet to consider these data as the absolute limits in time and distribution. It is not unlikely that, as in *jacksonoides,* the species lives outside forests in the herbal stratum, up to 50 cm above the soil, rather than close to the ground in leaf-litter, moss, and between the lower parts of grasses and herbs.

In the eastern Alps, *L. jacksoni* seems to be replaced by another species of this subgroup, *L. jacksonoides.* The latter has been found at 1,500 m and above in northern and eastern Switzerland, the Austrian Alps, and in Bulgaria. We do not know if and where the distributions of the two species meet or overlap. In fact, this kind of information might serve to evaluate the characters here used to distinguish between the two species.

All specimens mentioned by Schenkel in subsequent years have been reexamined. The only additional material that can be recorded here consists of 3♀ from Bedretto (Tessin), vii-viii, which were found in the collection of the Naturhistorisches Museum at Basel among specimens of *L. tenebricola* (Wider) and published under that name by Schenkel (1929: 10, p.p.).

The available material is listed here for completeness sake (all preserved in NMB).

Wallis: 1♂, Bez. Goms, Weg vom Hotel Jungfrau zum Märjelensee, 2190-2390 m, 21.vii.1923, E. Schenkel (lectotype); 1♀, Weg vom Hotel Jungfrau zum Eggishorn, oberer Teil, 2400-2934 m, 7. vii.1924, E. Schenkel (paralectotype). 1♀ 1♂, Umgebung Saas Fee, vii-viii; 2♀ 1♂, linker und rechter Talhang bei [Saas] Almagel, vii., figured.

Tessin: 1♂, Bedretto, rechter Talhang, vii; 3♀, Bedretto, vii-viii (*L. tenebricola,* Schenkel, 1929, p.p.).

Lepthyphantes jacksonoides Van Helsdingen, spec. nov.
(Fig. 43-46, 66)

Lepthyphantes nigriventris; Schmölzer, 1962: 269 (Austria, Nordtirol).
Lepthyphantes spec. nahe *jacksoni;* Palmgren, 1973: 31, Fig. 2 (Austria: Nordtirol, Kärnten, Salzburg).

This new species closely resembles *L. jacksoni* Schenkel, from which it can be distinguished by the shape of the lamella in the male palp, the stridulating files, and (tentative conclusion) by its distribution.

Types. — ♂ holotype from Austria, Osttirol, Umbaltal W. of Prägraten, 1300-1550 m, 4.viii.1973, P. J. van Helsdingen, from herbage along river; 2♀ 2♂, paratypes, collected with the holotype (whole series in ML).

Description. — Measurements (in mm). Total length, ♀ 2.15-3.2, ♂ 2.2-2.9; length cephalothorax, ♀ 1.0-1.22, ♂ 1.0-1.25. Legs: Fe I 1.1-1.25 times length cephalothorax in females, 1.1-1.3 times in males.

Coloration. Cephalothorax grey-brown, blackish-grey along margins. Legs light brown. Abdomen with light dorsal and lateral surfaces, not unlike *tenuis,* at first

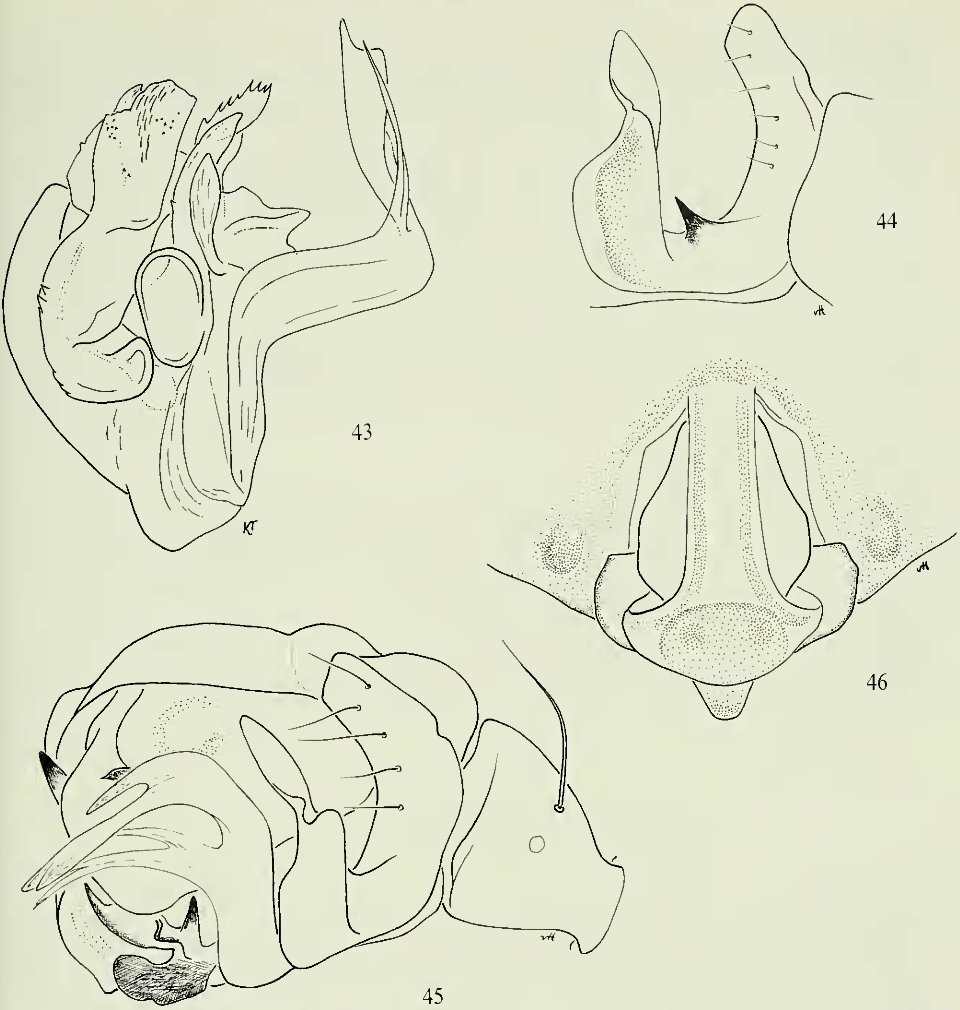


Fig. 43—46. *Lepthyphantes jacksonoides* Van Helsdingen, spec. nov., 43, radical section, ventral aspect; 44, paracymbium; 45, male palp, lateral aspect; 46, epigyne. 44—46, X 128; 43, X 265

sight; dark grey V-shaped markings narrow or interrupted in the middle and light lateral stripe broadly connected with the light areas of the dorsal surface, lighter areas strewn with many white blotches. In males pattern much reduced, but often still visible.

Stridulating files (Fig. 66) rather fine, especially basad, ridges closer together than in *jacksoni*.

Legs with the usual set of spines, as indicated for the genus. Position of retrodorsal (basal) spine on tibia I 0.29-0.34, length of this spine 0.31-0.35 mm in ♀, 0.21-0.28 mm in ♂. Tm I 0.20-0.26.

Male palp (Fig. 43-45). Resembling in general the palp of *jacksoni* but differing in the following respect. Dorsal and ventral branches of the lamellar tip not diverging (cf. Fig. 39), but dorsal branch slightly curved and roughly parallel to ventral one. Length of cymbium 0.40-0.47 mm (*jacksoni*: 0.42-0.45).

Epigyne (Fig. 46) hardly different from that of *jacksoni*, with the same kind of depression near the tip of the basal part of the scape. Width of basal part of scape 0.210-0.225, of inner scape 0.160-0.190, of posterior median plate 0.250-0.275 mm.

Distribution. — So far known to occur in Switzerland (Glarus, Graubünden) and Austria (Vorarlberg, Nordtirol, Osttirol, Salzburg, Kärnten). A female specimen from Bulgaria (in cave "Dupocheto" near Velingrad, distr. Pazerdjik) is thought to belong to *jacksonoides*, indicating a much wider distribution, but confirmation at the specific level has to wait until males become available from that area. Collected above 1,300 m and up to 2,400 m. It appears that the webs are (always ?) built in the vegetation at some distance from the soil (up to 50 cm), which is quite unusual for species of the *tenuis* group. The webs are thus more easily detected than in most other species of the group. Collecting dates range from June to September.

Rich material was available from Austria, mainly Nordtirol (figured), but the description of the species is largely based on the following specimens.

Switzerland: 1♀ 2♂, Glarus, Stausee Garichti near Schwanden, 1500-1600 m, 9.ix.1972, P. J. van Helsdingen, in herbage (ML). 2♀ 1♂ (palp only), Grisons (= Graubünden), Dr. Carl (MHNG) (not included in the type-series).

Austria: 1♂, Nordtirol, Zillertaler Alpen, Höllensteinloch, 1949, H. Janetschek (NMB). 2♀ 3♂, Osttirol, Umbaltal W. of Prägraten, 1300-1550 m, 4.viii.1973, P. J. van Helsdingen, from herbage along river (type-series; ML).

Lepthyphantes nigriventris (L. Koch)
(Fig. 47-49. 67)

Linyphia nigriventris L. Koch, 1879: 34, Pl. 1 Fig. 22-22a (descr. ♀, Siberia, Yenissey region).

Lepthyphantes nigriventris; Kulczyński, 1916: 20, Pl. 1 Fig. 29 (*nigriventer*; ♀, Siberia). Ermolajev, 1934: 138 (West Siberia). Holm, 1945: 8 (Sweden), 54, Fig. 16 a-d (descr. ♂, genitalia depicted); 1951: 144 (Swedish Lapland); 1952: 122 (Swedish Lapland); 1973: 71, 95, Fig. 73-74 (redescription of type-material, lectotype selected). Brinck & Wingstrand, 1949: 27. Hackman, 1954: 5, 53 (Newfoundland).

Types. — The original material of Koch consisted of 3♀ from the Yenissey region, Siberia. A lectotype (from Krasnoyarsk) was selected by Holm (1973: 95). All specimens are preserved in the Naturhistoriska Riksmuseet at Stockholm. We have examined the lectotype and one paralectotype.

Schmölzer's record (1962: 269) probably belongs to the closely related species from the eastern Alps, *L. jacksonoides* spec. nov.

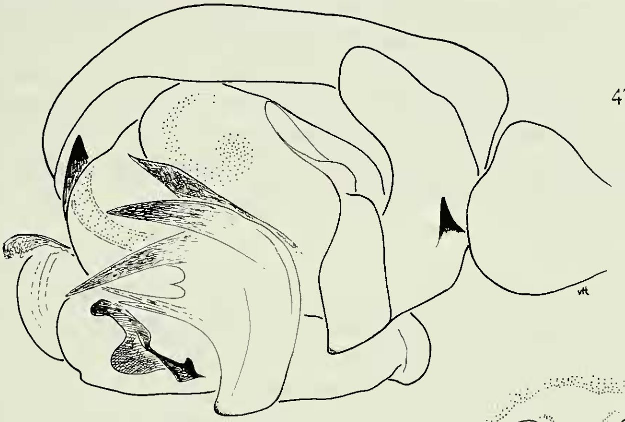
Diagnosis. — *L. nigriventris* belongs to the *jacksoni* subgroup, which is characterized by the pit or depression in the scapus of the epigyne, and by the laterally projecting lamellate structure of the terminal apophysis in the male palp. In *nigriventris* this projection is relatively short, and the position of the tooth on the paracymbium is also different from the other species of the subgroup.

Measurements (in mm). Total length, ♀ 2.9-3.4, ♂ (one specimen only) 2.6;

length cephalothorax, ♀ 1.23-1.32, ♂ 1.22. Legs: Fe I 1.2-1.3 times length cephalothorax in females, 1.33 times in male.

Stridulating files (Fig. 67) fine, ridges close together.

Male palp (Fig. 47, 48). Paracymbium with a single, large and slender tooth on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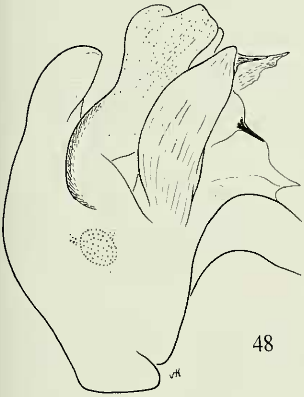
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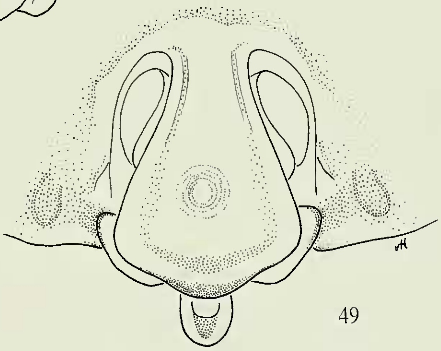
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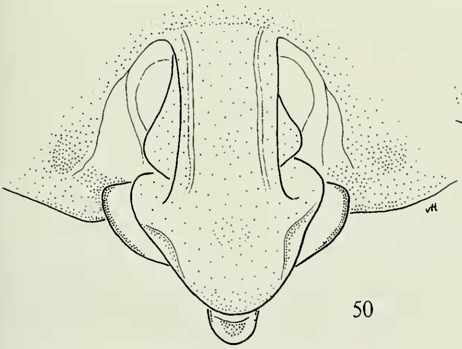
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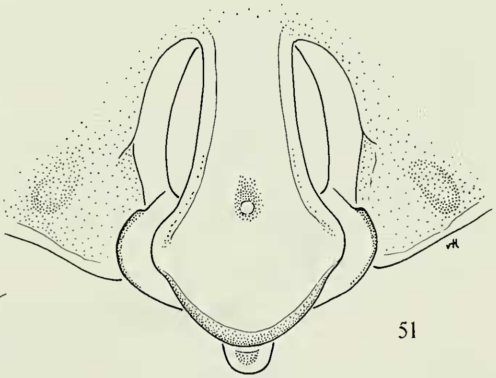
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Fig. 47—49. *Lepthyphantes nigriventris* (L. Koch). 47, male palp, lateral aspect; 48, radical section, ventral aspect; 49, epigyne. Fig. 50—51. *L. camtschaticus* Kulczyński. 50, epigyne (holotype); 51, epigyne (specimen mentioned by Schenkel, 1930). X 128

the proximal branch, close to the posterior margin, and not at the base of, and hidden behind, the distal branch (cf. *jacksoni* and *jacksonoides*). Lamella with diverging dorsal and ventral branches, both rather straight. Terminal apophysis with a lateral blade-like projection which is rather short and rounded (cf. *jacksoni* and *jacksonoides*). Embolus without denticles on the basal ridge (cf. *jacksoni* and *jacksonoides*). Length of cymbium (of specimen from Torne Träsk) 0.46 mm.

Epigyne (Fig. 49) with a distinctly pitted scape; basal part of scape gradually widening posterad; lateral lobes of inner scape rounded, inner scape about as wide as the basal part; posterior margin of basal part sclerotized, reminding of *tenebricola*. Posterior median plate distinct in the ventral aspect of the epigyne. Width of basal part of scape 0.180-0.200, of inner scape 0.165-0.200, of posterior median plate 0.235-0.250 mm.

Distribution. — Bonnet summarizes the distribution of this species as Norway, Sweden, Siberia. It has been found on several occasions in Swedish Lapland (Holm, 1945, 1951, 1952; Brinck & Wingstrand, 1949), while the original material of L. Koch from Siberia (Yenissey valley) was redescribed by Holm (1973: 95). A single female has been recorded from Newfoundland (Hackman, 1954). We have re-examined the specimen (Zoological Museum, Helsinki) and agree with the identification; the lighter areas of the abdomen are strewn with white blotches, a feature we have not observed in other specimens. *L. camtschaticus* Kulczyński, from Kamtchatka, might belong to this species, though the shape of the epigyne (no males known) is slightly different from that of *nigriventris* (see also the general discussion, p. 46).

According to Dr. T. Kronestedt of Stockholm (pers. comm.) the webs of this species are, again, found in the vegetation at some distance above the ground level (see also under *jacksonoides)*, not close to the surface as in most other species of the *tenuis* group.

Material examined. — We have seen the lectotype and one paralectotype from the Yenissey region (Briochowskij Islands, Chantajskoj, Krasnoyarsk) (NRS). From Swedish Lapland we received specimens from Mr. T. Kronestedt: 1♂ 2♀, Torne Lapmark, N. of Torne Träsk Lake, south side of Lullehatjårro mountain, 20-27.viii.1969, T. Kronestedt (ML).

Canada: 1♀, Newfoundland, St. Barbe Isl., Docters Hill, 29.vi.1949, E. Palmén, from litter (Zoological Museum, Helsinki).

The figures are based on the specimens from Swedish Lapland.

Lepthyphantes camtschaticus Kulczyński

(Fig. 50, 51)

Lepthyphantes camtschaticus Kulczyński, 1926: 33, 57, Pl. 2 Fig. 19 (descr. ♀; Kamtchatka). Schenkel, 1930: 17, Fig. 6 (descr. ♀; Kamtchatka). Holm, 1973: 95, Fig. 75 (compared with *L. nigriventris*).

Type. — The ♀ holotype is preserved in the collection of the Zoological Institute at Warszawa (examined); it originates from Klutschevskoje, Kamtchatka.

Diagnosis. — *Lepthyphantes camtschaticus* belongs to the *jacksoni* subgroup according to the median pit in the scape of the epigyne (absent in the holotype!). Only two specimens have ever been mentioned in the literature, both females. From these specimens it appears that the shape of the scape is slightly more prolonged than in *L. nigriventris.* It is difficult, at this moment, to assess the value of this character, because eastern Siberia is so poorly collected and no male specimens have become available as yet. It is not impossible that we are dealing with one polytypic species, which occurs in northern Europe (*nigriventris*), Siberia (*nigriventris*), Kamtchatka (*camtschaticus*), and the Nearctic region (Newfoundland; *nigriventris*) (see also the general discussion, p. 46).

Measurements (in mm). Female. Total length 3.4, length cephalothorax 1.20-1.37, Fe I 1.3 times as long as cephalothorax.

Stridulating files fine.

Epigyne (Fig. 50, 51). The distal end of the basal part of the scape is more prolonged posterad, thus giving it a more slender appearance; however, the width is the same as in *nigriventris* (0.20 mm). In the holotype, no pit is visible on the basal part of the scape, but in the specimen from Achomtenbay (Schenkel, 1930) a well-developed pit is present (Fig. 51).

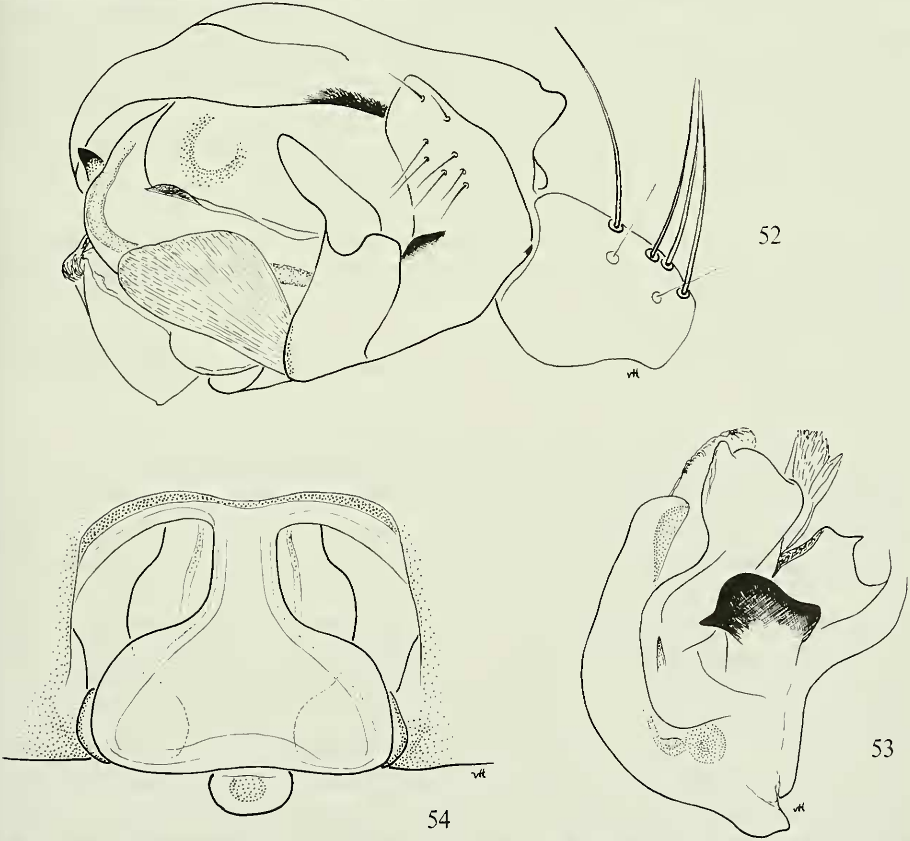

Fig. 52—54. *Lepthyphantes cristatus* (Menge). 52, male palp, lateral aspect; 53, radical section, ventral aspect; 54, epigyne. 52, 53, X 150; 54, X 220

Distribution. — Kamtchatka.

Material examined. — We have studied the ♀ holotype from Kamtchatka, Klutschevskoje, 10.viii.1909 (Warszawa), and the single ♀ specimen recorded by Schenkel (1930) from Achomtenbay, Kamtchatka (NRS).

Lepthyphantes cristatus (Menge)
(Fig. 52-54, 68)

Bathyphantes cristatus Menge, 1866: 121, Pl. 22 Fig. 46 (descr. ♀ ♂ ; Poland (Danzig)).
Lepthyphantes cristatus; Miller & Kratochvil, 1948: 139, 140, Fig. 2 a-d (compared with *L. pallidiventris*). Locket & Millidge, 1953: 386, Fig. 230A, 232E (♀ ♂). Wiehle, 1956: 192, Fig. 319-326 (♀ ♂). Wanless, 1971: 22, 26, Pl. 2, Pl. 6 Fig. E (♀); 1973: 129, 134, Pl. 1 Fig. 3, Pl. 6 Fig. 3 (♀).
Lepthyphantes cristatus pallidus Miller & Kratochvil, 1938: 238, 242, Fig. 3 (descr. ♀; Czechoslovakia).
Lepthyphantes pallidiventris Miller & Kratochvil, 1948: 139, 140, Fig. 2 e-h (nom. nov. pro *L. pallidus* Miller & Kratochvil, brought to species level; compared with *L. cristatus*; ♀ and ♂).

Remarks. — Miller & Kratochvil (1938) described a subspecies of *cristatus* from Czechoslovakia, which they subsequently raised to species level and, obligatory, renamed *pallidiventris* (1948). We have examined material kindly sent to us by Dr. Miller, and we did not find any substantial differential characters, notwithstanding the apparent differences which can be observed in the 1948 illustrations (Fig. 2, a-d, *cristatus,* e-h, *pallidiventris*). We are, therefore, of the opinion that *pallidiventris* is nothing but an extremely light-coloured form of *cristatus.* Specimens of this kind are frequently found, together with normally coloured specimens of *cristatus*, in Nordtirol, and a subspecific status is therefore out of the question. Consequently *L. pallidiventris* is listed in this paper as a junior synonym of *cristatus.*

Diagnosis. — *L. cristatus* takes an isolated position in the *tenuis* group because of the horned cymbium, the occurrence of several tibial spines in the male palp, and the deviating chaetotaxy.

Measurements (in mm). Total length, ♀ 2.3-2.7, ♂ 2.2-2.4; length cephalothorax, ♀ 0.95-1.05, ♂ 1.02-1.25. Legs: Fe I 1.1-1.25 times length cephalothorax in ♀, 1.2-1.3 times in ♂ .

Stridulating files fine (Fig. 68). Posterior tibiae (III and IV) with a retrolateral spine and thus differing from the other species of the *tenuis* group.

Male palp (Fig. 52, 53) at once distinguished from the other species of the group by the presence of four spines on the tibia and small tubercles at the proximolateral and proximo-mesal corners of the cymbium. Paracymbium with posterior margin slightly convex posterad and bearing a narrow ridge there which ends in a small sharp tooth at its dorsal limit; a serrate crest-like elevation at the base of the distal branch. Radix as usual, with the exception of the Fickert's gland, which appears to be modified in this species: the gland is followed distally by a second inflated, but less spherical, section of the spermduct. Distal section of lamella a simple flat structure, which fans out from the narrow base. Basal section of terminal apophysis strongly sclerotized and protruding. Basal section of embolus with one or two slender, tooth-like protrusions. Length of cymbium 0.44-0.51 mm.

Epigyne (Fig. 54) with basal part of scape rather suddenly widening from narrow "stem" to comparatively broad posterior section with rounded tips; lateral wings of inner scape roundish and gradually excavated anterad. Posterior median plate well visible but not much wider than basal part of scape. Width of basal part of scape 0.175-0.200, of inner scape 0.135-0.150, of posterior median plate 0.200-0.215 mm.

Distribution. — Up to 1940, *L. cristatus* had been recorded from nearly all European countries, with the exception of Greece, Portugal and Spain. European U.S.S.R. formed the eastern boundary, the Balkans and northern Italy were the southern limits. In the north-west there were records from Iceland and Greenland, but Braendegård (1958: 86) correctly pointed out that Jackson's (1930: 654) record of *cristatus* is to be found in an appendix on the Icelandic spider fauna at the end of his paper on the spiders of Greenland. Greenland thus has to be removed from the list of countries where the species has been found. Moreover, it appears now that in the Icelandic list Jackson only cites the older record for Iceland by Simon (1892: clxxvii) as do the other references to the occurrence on Iceland of *cristatus*. In the Paris collection a single male specimen from Iceland could be located which quite likely constitutes the material on which Simon's record was based. This specimen is not a *cristatus* but a *zimmermanni* and we therefore are inclined to believe that *L. cristatus* has never been found in Iceland.

A survey of the literature after 1940 revealed records of many of the European countries within the range indicated above, and also from northern Spain (Denis, 1962 b; Gerona).

The only cave records are by Drensky (1935: 98, 99, 102), from Yugoslavian caves.

We have examined material from Holland (not common), France, Austria (common), Czechoslovakia (common), and Yugoslavia. It is a species of the leaf litter and herbaceous layers in deciduous forests; in the Alps up to 1700 m, but in Scandinavia it is said to occur frequently in moors (Braun & Rabeler, 1969: 42; Palmgren, 1975: 59).

The figures are based on specimens from France (Dép. de l'Eure).

SPECIES INQUIRENDAE

The following species are considered to belong to the *tenuis* group, though their exact identity could not be established. It appeared either impossible to locate the type-material, or the specimens were incomplete and, therefore, unidentifiable.

Lepthyphantes foliatus Denis, 1945: 52, Fig. 1, Pl. 2 Fig. 25 (descr. ♀, Algeria).

The short description of the single female specimen Denis had before him when naming this species contains remarks on size and coloration. It is accompanied by a figure of the abdomen and a very small one of the epigyne. The latter is strongly suggestive of that of *L. tenuis* because of the anchor-shaped scape and the rounded lateral lobes. The size of the specimen agrees with that of *tenuis*, and so does the abdominal pattern, be it that in the latter the dark spots seem to be very contrasting with the lighter surroundings. *L. tenuis* is known to occur in Algeria, and it is quite possible that Denis had this species in the small collection of spiders from that region he had received from the British Museum (Natural History), London. The only answer to this question would be a re-examination of the specimen, but neither Denis' private collection, now at the Muséum National d'Histoire Naturelle at Paris, nor the collection at London seem to contain the ♀ holotype of *L. foliatus*. Its loss during the war has been suggested.

Lepthyphantes suldalensis Strand, 1903: 10, 17, Fig. 2 a-b (descr. ♂, Norway).

The illustrations and description of this species strongly suggest it to belong to the *tenuis* group, even though Strand himself compared it with *Lepthyphantes obscurus* (Blackwall). The original specimens could be located in the Paris Museum. There are two specimens, a subadult ♂ and an adult ♂, but in the latter most legs and both palps are lacking. Thus we are deprived of the most reliable set of characters. The remnants of the adult specimen give us no decisive answer to the question of the identity. It is not very likely that there occurs a separate species in southern Norway and we tend to refer it to one of the other species of the *tenuis* group. Judging by the size of the adult specimen (length cephalothorax 0.90 mm, length Fe I 1.12 mm) it could be *mengei, flavipes,* or *tenuis* (excluding *herbicola* on zoogeographical grounds). However, the stridulating files and shape of the chelicerae exclude *flavipes* (which has a latero-basal boss and the stridulating files very coarse, if visible at all). Comparison with specimens of *mengei* and *tenuis* suggest the former, mainly because of the fine stridulating files. *L. mengei* is common in Scandinavia, while *L. tenuis* appears to be much rarer.

Lepthyphantes tenoides Kolosváry, 1938: 66, 74, Fig. b, c (descr. ♀, Yugoslavia).

All that can be said at present is that the epigyne reminds of that of *L. tenuis,* the very reason why it was called *tenoides*. It certainly belongs to the *tenuis* group, but without the specimen it is impossible to place the species more precisely.

Nearctic representatives of the *tenuis* group

Beside *L. tenuis* (Alaska, British Columbia, Washington) and *nigriventris* (Newfoundland) there are a number of species which occur in the Nearctic Region and probably belong to this species-group: *cracens* Zorsch, described from New York; *zebra* Emerton, occurring in the eastern United States; *zelatus* Zorsch, closely related to *zebra* and found in Washington; and *zibus* Zorsch, also from Washington. The reader is referred to the treatise on the genus *Lepthyphantes* in the United States by Zorsch (1937).

DISCUSSION

From the outset we intended to present a survey of the *tenuis* group of species: to provide useful means for the recognition of the species, to summarize the known distributions, and to erect a framework of reliable characters for establishing infra-group relationships and for a correct placing of species to be described in the future.

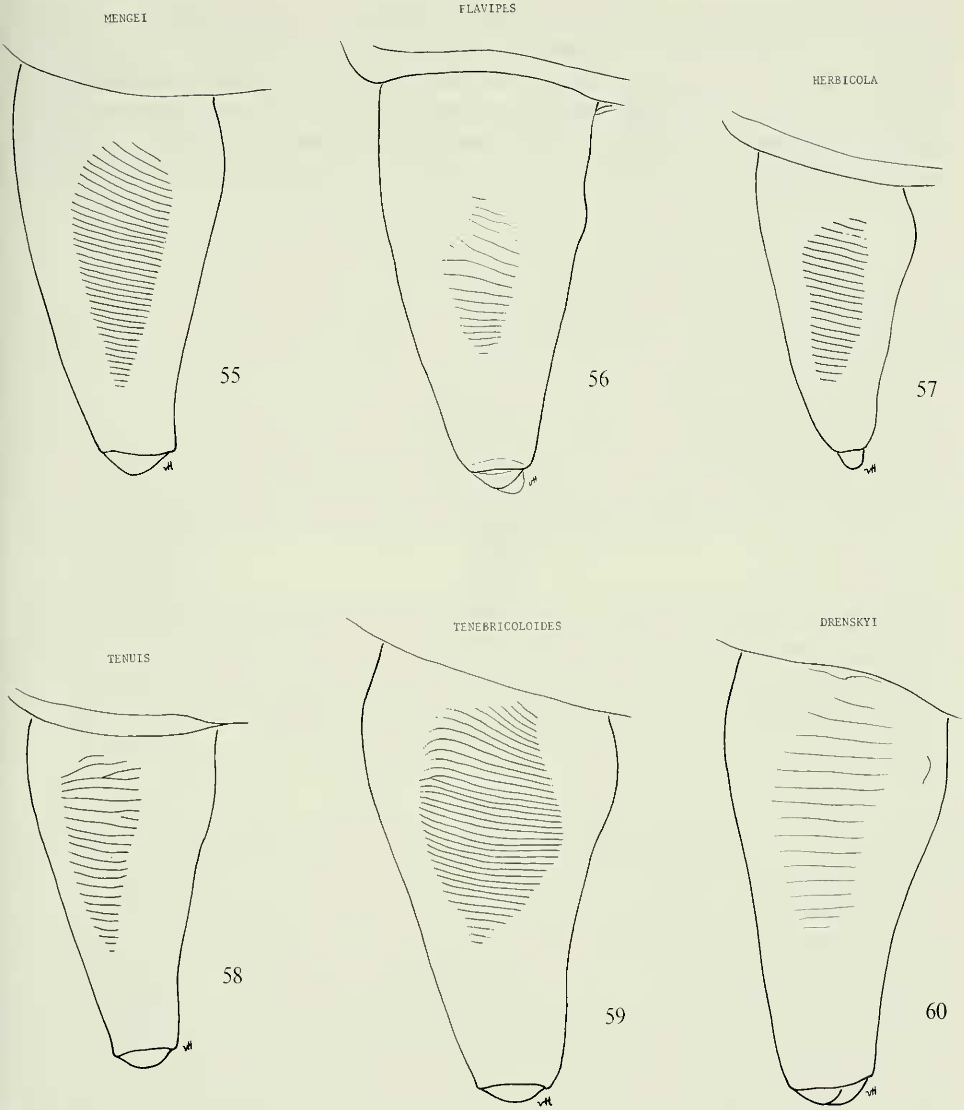

Fig. 55—60. Male chelicerae (but female of *flavipes*) of *Lepthyphantes* species, showing stridulating files. 59, X 112; 56, 58, 60, X 128; 57, X 135; 55, X 158

The approach had to be typological. The species treated here differ in a limited number of usable, mainly genital characters, and the differences are often so minute that variation is hard to trace. Apart from size and coloration, variation in the used differential genital characters only became apparent in a few instances, and then is discussed in the text. Most likely variability is as normal a phenomenon here as in other taxa, but it has to be studied independently, using more advanced methods such as scanning electron microscopy. In our present study it plays a minor role.

If one thing has become clear when studying this species-group, it is the poor state of knowledge of the group as a whole. This certainly is the result of inadequate literature, which, in the past, made it hard to identify a specimen at all. As pointed out in the introduction, we noticed a relatively high percentage of misidentifications in old collections. New species names appeared to have been proposed for specimens which in fact belong to the commonest members of the

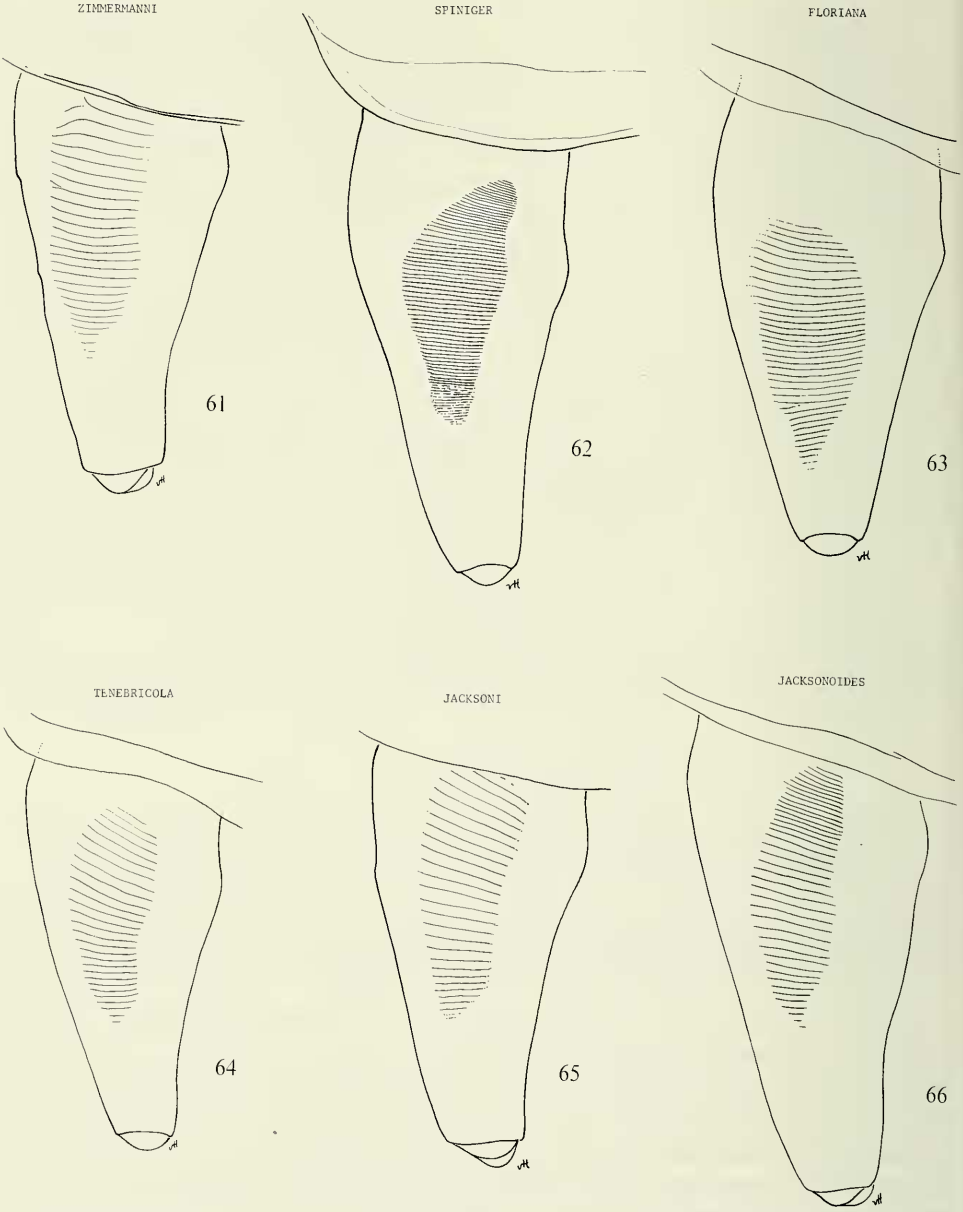

Fig. 61—66. Male chelicerae of *Lepthyphantes* species, showing stridulating files. X 128

tenuis group. All this certainly did not help to clarify the dark points in our knowledge of the interspecific relationships, the diagnostic value of traditionally used characters, and the distributional patterns. Consequently we have attempted to improve upon the unsatisfactory situation. By doing so, we became much aware of all the existing gaps, many of which we are unable to fill at present. That our knowledge of the distribution of northern species such as *L. nigriventris* and *camtschaticus* is fragmentary is understandable because of the inaccessibility of these areas. But when we have to state that we really do not know anything certain about the distribution of *zimmermanni* in the Balkan Peninsula, we have to admit that this is the result of lack of interest rather than lack of opportunities. Even though the Swiss and Austrian Alps are easily accessible and indeed have been the field of activity of several arachnologists, we still lack insight in the distributions of several species (again *zimmermanni,* among others), including their altitudinal zonation. It was only recently that we discovered the existence of two alpine species in that area, *jacksoni* in the west and *jacksonoides* in the east, without being able to establish the boundary, or the zone of overlap, between the two as a result of insufficient collecting of "common" *Lepthyphantes* species.

Characters used.

Hardly paying any attention to coloration and abdominal patters, which we suspect to be variable, we have incorporated size limits, proportional leg lengths, and chaetotaxy into the diagnosis. The chaetotaxy provide diagnostic characters in two cases only, viz., in *spiniger,* where the metatarsi bear more than the usual, single dorsal spine, and in *cristatus*, with its extra prolateral spines on tibiae III and IV.

The chelicerae show constant dentition through the whole group. The stridulating files, which are always present (with the *flavipes* ♂ as the only exception), have been used, more than before, to characterize species, though only in a comparative, qualitative way. The importance of this character lies in the assumption that it plays an active role in the maintenance of hybridization barriers, effectively isolating the species from each other. The organ is used during courtship, and we may assume that differently built stridulating files produce different vibrations in the web, and that positive response of a female is only evoked by a male of the same species, producing the right vibration. Comparative use of the files in the present paper is made possible by presenting figures of the male stridulating files of all species. A quantitative analysis has not been undertaken because several technical problems are involved, such as the changing interstices of the ridges of the files from base to apex. All epigynes are of comparable structure, i.e. a long sigmoid scape with a stretcher on top, arising from the anterior wall of an atrium, which at the posterior side is bordered by the medially incised posterior median plate. There is no reason to assume basic differences in the functional properties of the organ in the different species. Since the inner scape, apart from the shape of the lateral wings, has not been included in this study we cannot make use of these parts in differentiating the taxa. From Wanless' study (1973) of the epigynes of the British species of this genus it is clear that not much can be gained from these hidden parts. Only *cristatus* is slightly

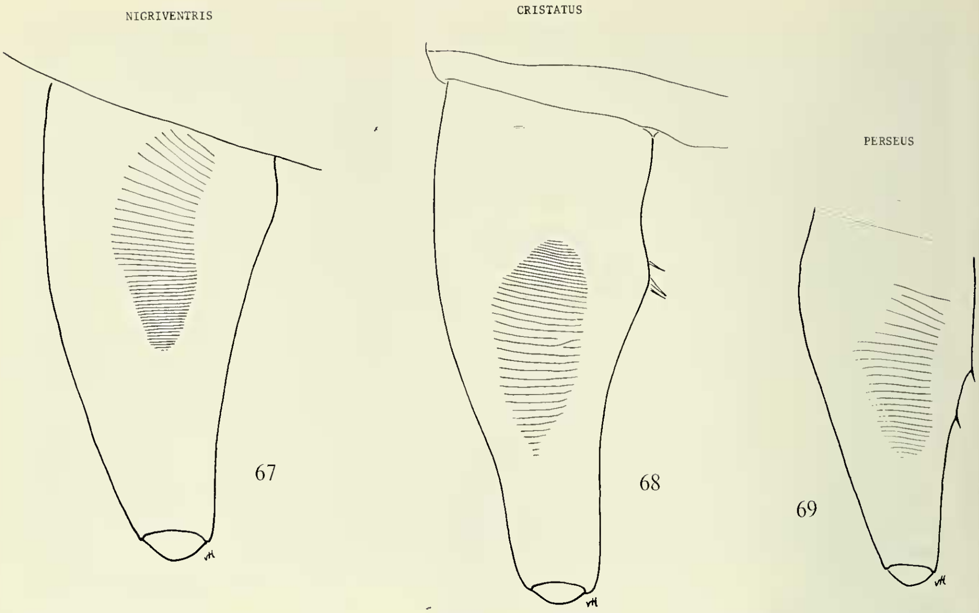

Fig. 67—69. Male chelicerae of *Lepthyphantes* species, showing stridulating files. 67, 68, X 128; 69, X 135

different from the other species. We have observed the scape, therefore, only in the ventral aspect, using the shapes of the basal part of the scape, the visible lateral wings of the inner part, and, of course, the presence or absence of a pit or depression on the basal part.

As to the latter, we may speculate about the functional properties of the pit and depression. From the analysis of the functions of the different elements of the male palp and the epigyne in *L. leprosus* (Ohlert) (Van Helsdingen, 1965), we know that the male palp is firmly anchored on the epigyne by, among others, the male paracymbium. We have already pointed out that in all species with pitted scapes or scapes with depressions the paracymbium of the male palp bears a long tooth. It is not impossible that the large tooth on the paracymbium is functionally correlated with the pit or depression. We must keep in mind though, that the larger tooth on the paracymbium is differently situated in the different species: at the base, and rather at the inside of, the distal branch (*tenebricola, jacksoni, jacksonoides*), or on the proximal branch (*nigriventris*).

In the male palp, the following characters have been used: dentition of paracymbium, shape of lamella, dentition of basal section of embolus, and possible conspicuous parts of the terminal apophysis. Of these the paracymbial characteristics and the presence of a conspicuous protruding portion of the terminal apophysis have been used for subgroup delimitation. The other characters could not be used for this purpose, but only contributed in a purely typological way to species differentiation.

Infra-group relationships.

With the aid of the characters mentioned, we can distinguish certain subgroups or clusters of species within the *tenuis* group, though it is not possible to divide all species among these clusters. Starting with the species with pit-bearing scapes, we may bring together *nigriventris* (Fig. 49), *camtschaticus* (Fig. 51), and *tenebricola* (Fig. 37).

The scape does not have a pit in the holotype of *camtschaticus*, but it is present in a second specimen from the same region; *camtschaticus* also is suspected to be very close to *nigriventris*, with which it might form a superspecies or polytypic species. However that may be, both have the typical sclerotized posterior margin of the basal part of the scape, a feature we know so well from *tenebricola*. This latter species is now revealed as exceptionally possessing a pitted scape (Fig. 37). The male palps in the two species mentioned here (we do not have a male of *camtschaticus*) have one thing in common, viz., the relatively large, blade-like projecting part of the terminal apophysis (Fig. 36, 47); in both the paracymbium bears a strong tooth, though of different position and in the case of *tenebricola* accompanied by a second tooth. In two other species, *jacksoni* and *jacksonoides*, both male characters are equally present (Fig. 39, 40, 45, 46): the blade-like projecting part of the terminal apophysis, which is even larger here and quite conspicuous, while the paracymbium does have a large tooth, in position comparable to the larger tooth of *tenebricola*. The females of these two species do not have pitted scapes, but both have the rather conspicuous depression near the tip of the exposed basal part of the scape (Fig. 42 and 46). The pit and the depression found in this subgroup might be functionally analogous structures.

A second subgroup is constituted by *L. zimmermanni* and the closely resembling *spiniger* and *floriana*. The epigynes of these three species are hardly different as to the shape of their scapes; all three have proportionally broad posterior median plates. The males have a number of features in common, but as a group they cannot be clearly delimited from the other species. For instance, the basal section of the embolus bears denticles in the three species mentioned, but so it does in *tenuis* and *drenskyi*. Of the latter the female is still unknown, but the female of *tenuis* differs from the *zimmermanni* type (compare Fig. 16 and 24, 30, and 34). *L. herbicola* would, according to the epigyne (Fig. 15), fit in with the *zimmermanni* type, but there are no denticles on the embolus, and the shape of the lamella deviates considerably from what is found there (compare Fig. 13 and 27, 28, and 31).

The teeth on the paracymbium give no clue; they are quite useful for the separation of the species, but relationships cannot be inferred from their numbers, positions, — or absence. We have not succeeded, therefore, in delimiting the *zimmermanni* subgroup more precisely.

We feel that *cristatus* stands quite isolated, forming a possible link with one of the other (natural?) species-groups of the genus; the spinose palpal tibia, the cymbium with its two tubercles, the spatulate lamella, and the strongly sclerotized basal section of the embolus, are not found in any of the other species.

L. mengei and *flavipes* seem to be closely related, which might be a mere suggestion because of their small size and the absence of denticles on the embolus, which character also might be correlated with size. *L. perseus* from Iran, described as new in this paper, most likely is related to these two species, even though the embolic dentition is present. *L. tenebricoloides,* endemic to Madeira and the Canary Islands, rather strongly deviates from the general type; it is larger than most other species, and lacks denticles on the embolus as well as on the paracymbium. *L. drenskyi* and *tenuis* resemble each other very closely in the shape of the lamella and the number of denticles on the basal section of the embolus.

Zoogeographical remarks and possible evolutionary lines.

If we correctly have brought together *tenebricola, nigriventris, camtschaticus, jacksoni,* and *jacksonoides* in one natural subgroup, we may try and find an explanation for the present distribution of the species. Of the species under consideration, *tenebricola* certainly has the widest and most central distribution. It occurs in Europe and probably in Asia (Kamtchatka record), as far north as Lapland, as far south as Spain and Italy. In the Alps it reaches an altitude of 2,000 m. In Swedish Lapland it occurs together with *nigriventris,* which may reach much further north and is more adapted to open grassland habitats, while *tenebricola* can be classified as ombrophilous. *L. nigriventris* may have evolved from northern populations of *tenebricola,* which became isolated by the advancing ice-cover in the colder pleistocene periods, and survived in the relatively mild and ice free regions of southern Finland and Siberia (Yenissey region). A similar situation may have occurred in the Alps, where *jacksoni* and *jacksonoides* have a subalpine to alpine distribution (1,300 m and above) and are found in more open vegetation outside the forest. *L. tenebricola* does not occur above 2,000 m and is more or less restricted to the forested areas. Its distribution probably is limited by, or coincides with, the timber-line. The northeast-southwest differentiation into two species may result from the former existence of isolated refugia in the Alps. It is not likely that they represent cases of Nunatak survival, because they are now not of exclusive alpine distribution. We rather think of isolated regions, cut off from the main population of *tenebricola* by chains of glaciated mountains. We know of many of these areas that remained free of ice during the main glaciations (cf. Holdhaus, 1954, map 36).

As pointed out when summarizing the distribution of *L. zimmermanni,* this species has a wide European distribution, which, however, leaves a remarkable hiatus in the eastern Alps and the mountainous regions of the Balkans. All specimens examined from Switzerland came from the western part, mainly the northwestern plain. The species does not occur in the eastern part, nor in Nordtirol, while in Czechoslovakia it is said to be very rare (Buchar, pers. comm). From Hungary there is no record; from Rumania it was erroneously mentioned and the specimens concerned are described as a new species (*floriana*) in this paper. South of the Alps it is known to occur in Italy and northern Yugoslavia. From Bulgaria there is an isolated cave record, but we must not forget, of course, that the European population continues eastward in Poland and the European part of the U.S.S.R. *L. floriana* in our opinion is closely related to *zimmermanni*; so far it is only known from one locality near Bucarest and one in Bulgaria; it may have evolved there from a marginal population of *zimmermanni.*

In the southwest we have a comparable case. Here we find *L. spiniger,* which, if we are not mistaken, is restricted to the Pyrenees, where it inhabits the entrances of caves and dolines, as well as the litter stratum of pine forest. There are many records of *zimmermanni* from the Pyrenees (in Denis' papers on the spider fauna of that region) and at present the two species are not clearly isolated geographically. It is impossible to speculate here, with our restricted knowledge of the ecological preferences of the two species and of the details of their distributions in the Pyrenees, about the possible influence of the glaciations on the development of these two closely related species.

Only two species have been reported with certainty from Madeira and the Canary Islands, viz., *tenuis* and *tenebricoloides*. According to Schmidt (1975 a and b) both species are subject to more than the usual variation in this archipelago. A specimen of *tenuis* from La Palma was reported (Schmidt, 1975 b) to be much darker than specimens of the mainland populations, a specimen from Gomera appears to be much smaller (Schmidt, 1975 a). Specimens of *tenebricoloides* from Gomera (Schmidt, 1975 a) show differences in the genitalia as well as in size, as compared to the original series from Madeira. It is not surprising that Madeira and the Canary Islands have their own endemic representative (*tenebricoloides*) of the *tenuis* group. This is a well-known phenomenon in many groups of animals, and there are many examples of endemic spiders from these islands. Future investigations may bring to light to what extent the different islands of the archipelago have their own characteristic populations of *tenebricoloides* or related species. Several islands are not yet investigated. As to *tenuis*, we can hardly expect to find much differentiation among the island populations. Again we do not know exactly on which islands the species occurs (so far recorded from Madeira, Gomera, La Palma, and also from the Açores). But *tenuis* apparently is easily dispersed by man, as witness the occurrence in New Zealand, and it is not very likely that different populations have evolved under these conditions. The region certainly is worth special attention.

At the present stage nothing is to be gained from a speculation on the relationships among the remaining species. Our insight in the meaning of the used characters is too superficial. However, progress is helped by a number of factors, which we hope to have made possible through this contribution. In the first place many more records are needed for all the species of this group, with as many particulars on habitats to be recorded as possible. For some species the interest should be focussed on certain regions, viz., the Alps, the Carpathian Mountains, the Balkan Mountains, and the Apennines. There is also no reason why the *tenuis* group should not be represented in the Taunus or Caucasus. The occurrence of *tenuis* in Afghanistan (Denis, 1958) and the recent discovery of *perseus* in Iran clearly show that we may expect representatives of this species-group to occur farther to the east and south. Our knowledge of the faunas of these regions is very poor, certainly as regards the Linyphiidae. We kindly invite the attention of all arachnologists to this interesting group of species.

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References

Alberti, G., 1967. La collezione araneologica del Museo Civico di Storia Naturale di Trieste. Catalogo dei tipi. — Atti Mus. Civ. Stor. Nat. Trieste 26: 25—28.

Berland, L., 1932. Voyage de MM. L. Chopard et A. Méquignon aux Açores (août-septembre 1930). II. Araignées. — Ann. Soc. Ent. France 101: 69—84.

Bertkau, P., 1890. Arachniden gesammelt vom 12. November 1888 bis zum 10. Mai 1889 in San Remo von Prof. Dr. Oskar Schneider: 1—11.

Blackwall, J., 1852. A catalogue of British spiders, including remarks on their structure, functions, oeconomy and systematic arrangement. — Ann. Mag. Nat. Hist. (2) 9: 15—22.

———, 1854. Descriptions of some newly discovered species of Araneidea. — Ann. Mag. Nat. Hist. (2) 13: 173—180.

———, 1864. A history of the spiders of Great Britain and Ireland. Part 2: 175—384, Pl. 13—29. — Ray Society, London.

Bokor, E., 1922. [Arthropoden der ungarischen Grotten.] — Barlangkutatas 9: 1—22, 45—49.

Bonnet, P., 1957. Bibliographia Araneorum 2 (3): 1927—3026. — Toulouse.

Braendegård, J., 1932. 3. Araneae. In: Isländische Spinnentiere 1. Opiliones, Chernetes, Araneae. — Göteborgs Kungl. Vetenskaps- Vitterhets-Samh. Handl., (B) 2 (7): 8—36, Fig. 1—10.

———, 1958. Araneida. In: The Zoology of Iceland 3 (54): 1—113, Fig. 1—88.

Bragg, P. D., & R. E. Leech, 1972. Additional records of spiders (Araneida) and harvestmen (Phalangida) for British Columbia. — Journ. Ent. Soc. British Columbia 69: 67—71.

Braun, R., 1960. Neues zur Spinnenfauna des Rhein-Main-Gebietes und der Rheinpfalz. — Jahrb. Nassauischen Ver. Naturk. 95: 27—89.

———, 1969. Zur Autökologie und Phänologie der Spinnen (Araneida) des Naturschutzgebietes "Mainzer Sand". Gleichzeitig ein Beitrag zur Kenntnis der Thermophilie bei Spinnen. — Mainzer Naturw. Arch. 8: 1—107.

Braun, R., & W. Rabeler, 1969. Zur Autökologie und Phänologie der Spinnenfauna des nordwestdeutschen Altmoränen-Gebiets. — Abh. Senckenb. Naturf. Ges. 522: 1—89.

Brignoli, P. M., 1971. Note su ragni cavernicoli Italiani (Araneae). — Fragm. Ent. 7: 121—229, Fig. 1—136.

Brinck, P., & K. G. Wingstrand, 1949. The mountain fauna of the Virihaure area in Swedish Lapland, 1. — Kungl. Fysiogr. Sällsk. Handl., NF. 60 (2): 1—70.

———, 1951. Idem, 2. — Kungl. Fysiogr. Sällsk. Handl., N.F. 61: 1—173.

Caporiacco, L. di, 1936. Saggio sulla fauna aracnologica del Casentino, Val d'Arno Superiore e Alta Val Tiberina. — Festschr. Strand 1: 326—369, Fig. 1—5.

———, 1949. Una piccola raccolta aracnologica dei monti di Calabria. — Atti Mus. Civ. Stor. Nat Trieste 17: 132—136, one Fig.

———, 1950. Aracnidi cavernicoli Liguri. — Ann. Mus. Civ. Stor. Nat. Genova 64: 101—110, Fig. 1—2.

Chyzer, C., & V. Kulczyński, 1894. Araneae Hungariae 2 (1), Theridioidae: 1—151, Pl. 1—5.

Cloudsley-Thompson, J. L., 1948. Note on Arachnida 6. Spider records from Britain and Iceland. — Ent. Month. Mag. 84: 240.

Dalmas, R. de, 1917. Araignées de Nouvelle Zélande. — Ann. Soc. Ent. France 86: 317—430, Fig. 1—76.

———, 1922. Catalogue des araignées récoltées par le Marquis G. Doria dans l'ile Giglio (Archipel Toscan). — Ann. Mus. Civ. Stor. Nat. Genova 50: 79—96.

Deltshev, C., 1972 a. A contribution to the study of spiders (Araneae) from the caves in Bulgaria II. Genus *Lepthyphantes* in Bulgarian caves. — Bull. Inst. Zool. Mus. 36: 137—147, Fig. 1—10.

———, 1972 b. A review of spiders (Araneae) from Bulgarian caves. — Proc. 5th Int. Congr. Arachn., Brno 1971: 99—104.

———, 1973. A contribution to the study (Araneae) of spiders from the caves of Bulgaria. III. Ecological notes on spiders (Araneae) from the entrance parts of the caves. — Bull. Inst. Zool. Mus. 38: 39—47, Fig. 1, Tab. 1—2.

Denis, J., 1933 a. Chasses arachnologiques dans les Pyrénées-Orientales (Region de Banyuls-sur-Mer et Vallespir). — Bull. Soc. Hist. Nat. Toulouse 65: 529—591, Fig. 1—4.

———, 1933 b. Liste d'araignées recueillies dans le département du Var. — Ann. Soc. Hist. Nat. Toulon (1932-1933) 17: 85—102.

———, 1934. Eléments d'une faune arachnologique de l'ile de Port-Cros (Var). — Ann. Soc. Hist. Nat. Toulon 18: 136—158.

———, 1935. Liste des araignées recueillies dans le département du Var (2e note). — Ann. Soc. Hist. Nat. Toulon 19: 104—113.

———, 1938. A contribution to the knowledge of the spiderfauna of the Andorra valleys. — Proc. Zool. Soc. London 107B: 565—595, Pl. 1, Fig. 1.

———, 1941. Les araignées des Iles Canaries. — Ann. Soc. Ent. France 110: 105—130, Fig. 1—16.

———, 1945. Descriptions d'araignées Nord-Africaines. — Bull. Soc. Hist. Nat. Toulouse 79: 41—57, Fig. 1—2, Pl. 1—2.

———, 1949. Sur quelques araignées de Provence. — Bull. Soc. Zool. France 74: 16—18, Fig. 1—4.

———, 1952. Études Biospéologiques 35 (1). Araignées récoltées en Roumanie par Robert Leruth, avec un appendice sur quelques araignées cavernicoles de Belgique. — Bull. Inst. Roy. Sci. Nat. Belgique 28 (12): 1—50, Fig. 1—47.

———, 1957. Araignées du massif calcaire des Eaux-Bonnes (Basses-Pyrénées). — Bull. Soc. Hist. Nat. Toulouse 92: 245—258, Fig. 1—8.

———, 1958. Araignées (Araneidea) de l'Afghanistan. I. The 3rd Danish Expedition to Central Asia. Zoological results 22. — Vidensk. Medd. Dansk Naturh. Foren. 120: 81—120, Fig. 1—54.

———, 1959. Quelques araignées cavernicoles des Pyrénées. — Ann. Spéléol. 14: 219—231, Fig. 1—5.

———, 1962 a. Les araignées de l'archipel de Madère (Mission du Professeur Vandel). — Anais Fac. Cienc. Porto 44: 1—119, Pl. 1—12.

———, 1962 b. Quelques araignées d'Espagne centrale et septentrionale et remarques synonymiques. — Bul. Soc. Hist. Nat. Toulouse 97: 276—292, Fig. 1—15.

———, 1963. Spiders from the Madeira and Salvage Islands. — Bol. Mus. Mun. Funchal 17: 29—48, Fig. 1—12.

———, 1964. Spiders from the Azores and Madeira. — Bol. Mus. Mun. Funchal 18: 68—102, Fig. 1—23.

———, 1967. Quelques captures d'araignées Pyrénéennes (III). — Bull. Soc. Hist. Nat. Toulouse 103: 32—50.

Drensky, P., 1931. Paiatzi ot pescherite na Beulgaria. Höhlen-Spinnen aus Bulgarien. — Spis. beulg. Akad. Naouk 44: 1—50.

———, 1935. Über die von Dr. Stanko Karaman in Jugoslavien und besonders in Mazedonien gesammelten Spinnen (Araneae). — Izw. tzar. prirod. Inst. Sofia 8: 97—110, 7 Fig.

Dresco, E., 1949. Recherches souterraines dans les Pyrénées Centrales (Notes biospéologiques; année 1947). — Bull. Soc. Hist. Nat. Toulouse 84: 182—196.

———, 1960. Catalogue raisonné des araignées et des opilions des grottes du canton du Tessin (Suisse).

— Ann. Spéléol. 14: 359—390, Fig. 1—26.

Dresco, E., & J. F. Jézéquel, 1961. Attribution d'un rang spécifique à *Lepthyphantes zimmermanni* Bertkau 1890 s. sp. *spiniger* E. Simon 1929 (Araneae, Linyphiidae). — Bull. Mus. Nat. Hist. Nat. (2) 33: 105—108, Fig. 1—6.

Ermolajev, W., 1934. Materialien zur Spinnenfauna West-siberiens. — Fol. Zool. Hydrobiol. 7: 130—148.

Fage, L., 1931. Araneae, 5e serie, précédée d'un essai sur l'évolution souterraine et son déterminisme. Biospeologica LV'. — Arch. zool. Exper. 71: 91—291.

Forcart, L., 1961. Katalog der Typusexemplare in der Arachnida-Sammlung des Naturhistorischen Museums zu Basel: Scorpionidea, Pseudoscorpionidea, Solifuga, Opilionidea und Araneida. — Verhandl. Naturf. Ges. Basel 72: 47—87.

Galiano, E. F., 1910. Datos para el conocimiento de la distribución geográfica de los Arácnidos en España. — Mem. Soc. Esp. Hist. Nat. 6: 343—424.

Hackman, W., 1951. Bidrag till kännedomen om spindelfauna i provinsen Tavastia borealis. — Mem. Soc. Fauna Flora Fennica 26: 82—85.

———, 1954. The spiders of Newfoundland. — Acta Zool. Fennica 79: 1—99, Fig. 1—121, Map 1—5.

Hasselt, A. W. M. van, 1885. Catalogus Aranearum hucusque in Hollandia inventarum. — Tijdschr. Ent. 28: 113—188.

Helsdingen, P. J. van, 1963. The Micryphantidae and Linyphiidae (Araneida) of the Netherlands, with some notes on the genus *Lepthyphantes* Menge, 1866. — Zool. Verh. 62: 1—38, Fig. 1—6.

———, 1965. Sexual behaviour of *Lepthyphantes leprosus* (Ohlert) (Araneida, Linyphiidae), with notes on the function of the genital organs. — Zool. Med. 41: 15—42, Fig. 1—19, Pl. 1—2.

Holdhaus, K., 1954. Die Spuren der Eiszeit in der Tierwelt Europas. — Abh. Zool.-Bot. Ges. Wien 18: 1—493, Pl. 1—52, one map.

Holm, A., 1945. Zur Kenntnis der Spinnenfauna des Torneträskgebietes. — Ark. Zool. 36A (15): 1—80, Fig. 1—26.

———, 1951. Araneae. In: P. Brinck & K. G. Wingstrand, The mountain fauna of the Virihaure area in Swedish Lapland. II. Special account. — Kungl. Fysiogr. Sällsk. Handl., NF. 61: 138—149, Fig. 7—8.

———, 1952. Studien über die Spinnenfauna des Torneträskgebietes. — Zool. Bidr. Uppsala 29: 103—213, Fig. 1—26, Tab. 1—5.

———, 1959. Spindlar fran Härjedalens fjälltrakter. — Ent. Tidskr. 79: 216—230.

———, 1970. Notes on spiders collected by the "Vega" Expedition 1878—1880. — Ent. Scand. 1: 188—208, Fig. 1—42.

———, 1973. On the spiders collected during the Swedish expedition to Novaya Zemlya and Yenisey in 1875 and 1876. — Zool. Scripta 2: 71—110, Fig. 1—117.

Huhta, V., 1965. Ecology of spiders in the soil and litter of Finnish forests. — Ann. Zool. Fennici 2: 260—308, Fig. 1—14.

———, 1971. Succession in the spider communities of the forest floor after clear-cutting and prescribed burning. — Ann. Zool. Fennici 8: 483—542, Fig. 1—37, Tab. 1—16.

Hull, J. E., 1933. Nomenclature of British Linyphiid spiders: A brief examination of Simon's French catalogue. — Trans. North. Nat. Un. 1: 104—110.

Hull, J. E., & J. W. H. Harrison, 1937. The natural history of the Island of Raasay and of the adjacent isles of South Rona, Scalpay, Longay, and Fladday. — Scott. Natural. 226: 107—113.

Jackson, A. R., 1930. Results of the Oxford University Expedition to Greenland, 1928. Araneae and Opiliones collected by Major R. W. G. Hingston; with some notes on Icelandic spiders. — Ann. Mag. Nat. Hist. (10) 6: 639—656, Pl. 17.

Keyserling, E., 1886. Die Spinnen Amerikas. 2. Theridiidae, 2e Hälfte: 1—295, Pl. 11—21. — Nürnberg.

Koch, L., 1879. Arachniden aus Siberien und Novaja Semlja, eingesammelt von der schwedischen Expedition im Jahre 1875. — Kungl. Svenska Vet.-Akad. Handl. 16 (5): 1-136, Pl. 1—7.

Kolosváry, G., 1928. Die Spinnenfauna der ungarischen Höhlen. — Mitt. Höhl. Karstforsch. 1928: 109—113.

———, 1938. Sulla fauna aracnologica della Jugoslavia. — Rasseg. Faun. 5: 61—81.

Kulczyński, V., 1887. [Symbola ad faunam Arachnoidarum Tirolensem.] — Rozpr. spraw. wydz. mat.-przyrod. Akad. umiej. 16: 245—356, Pl. 5—8.

———, 1916. Araneae Sibiriae Occidentalis Arcticae. — Mém. Acad. Imp. Sci. (Petrograd) (8) 28 (11): 1—2 + 1—44, Pl. 14—15.

———, 1926. Arachnoidea camtschadalica. — Ann. Mus. Zool. 27: 29—72, Pl. 2—3.

Lehtinen, P. T., & A. Kleemola, 1962. Studies on the spider fauna of the southwestern archipelago of Finland. I. — Arch. Soc. Zool. Bot. Fennicae "Vanamo" 16: 97—114, Fig. 1—17.

Leruth, R., 1935. Exploration biologique des cavernes de la Belgique et du Limbourg hollandais, xxviie contribution: Arachnida. — Bull. Mus. Roy. Hist. Nat. Belgique 11 (39): 1—34.

———, 1939. La biologie du domaine souterrain et la faune cavernicole de la Belgique. — Mém. Mus. Hist. Nat. Belgique 87: 1—506, Fig. 1—61.

Lindroth, C. H., 1957. The faunal connections between Europe and North America: 1—344, Fig. 1—61, Tab. 1—9, Diagr. 1—11. — Stockholm.

Locket, G. H., & A. F. Millidge, 1953. British Spiders 2: 1—449, Fig. 1—254. — Ray Society, London.

Locket, G. H., A. F. Millidge & P. J. van Helsdingen, 1970. An observation on the type material of *Lepthyphantes tenebricola* (Wider) (*Linyphia tenebricola* Wider 1834). — Bull. Brit. Arachn. Soc. 1: 90—91, Fig. 1—8.

Menge, A., 1866. Preussische Spinnen: 1—560 + 1—11, Pl. 1—91. — Danzig.

Miller, F., 1947. Pavouci zviřena hadcovych stepi u Mohelna. In: Mohelno, 7: 1—107, Pl. 1—16.

Miller, F., & J. Kratochvil, 1938. [Quelques nouvelles araignées pour la faune tchécoslovaque.] — Cas. Narodn. Mus. Praze 1934: 234—244, Fig. 1—4.

———, 1948. [Notes sur trois èspèces du genre *Lepthyphantes* Menge.] — Ent. Listy 11: 137—140, Fig. 1—2.

Moritz, M., 1968. *Lepthyphantes zebrinus* (Menge), ein Wiederfund für die deutsche Spinnenfauna (Araneae, Linyphiidae). — Deutsch. Ent. Zeitschr., N.F. 15: 399—407, Fig. 1—12.

Niculescu-Burlacu, F., 1968. Contribuţii la studiul faunei de Aranee din Pădurea Brăneşti. — Stud. Cerc. Biol., Zool. 20: 89—94, Fig. 1—7.

Palmgren, P., 1972. Studies on the spider populations of the surroundings of the Tvärminne Zoological Station, Finland. — Comment. Biol. 52: 1—133, Fig. 1—16, Pl. Fig. 1—23.

———, 1973. Beiträge zur Kenntnis der Spinnenfauna der Ostalpen. — Comment. Biol. 71: 1—52, Fig. 1—3.

———, 1975. Die Spinnenfauna Finlands und Ostfennoskandiens VI. Linyphiidae 1. — Fauna Fennica 28: 1—102, Fig. 1—23, Map 1—21.

Polenec, A., 1958. Ekolska raziskovanja arahnidske favne iz nekaterih gozdnih tipov v okolici Kranja. — Biol. Vestnik 6: 92—117.

Roewer, C. F., 1942. Katalog der Araneae von 1758 bis 1940. 1 Band: i-viii, 1—1040. — Bremen.

Schenkel, E., 1925. Beitrag zur Kenntnis der Schweizerischen Spinnenfauna. — Rev. Suisse Zool. 32: 253—318, Fig. 1—14.

———, 1927. Beitrag etc. III. Teil. Spinnen von Saas-Fee. — Rev. Suisse Zool. 34: 221—267, Fig. 1—21.

———, 1929. Beitrag etc. IV. Teil. Spinnen von Bedretto. — Rev. Suisse Zool. 36: 1—24, Fig. 1—6.

———, 1930. Die Araneiden der schwedischen Kamtchatka-Expedition 1920—1922. — Ark. Zool. 21A (15): 1—33, Fig. 1—13.

———, 1933. Beitrag etc. V. Teil. Spinnen aus dem Saas-Tal (Wallis) und von der Gegend zwischen Trins und Flims (Graubünden). — Rev. Suisse Zool. 40: 11—29, Fig. 1—2.

———, 1938. Die Arthropodenfauna von Madeira nach den Ergebnissen der Reise von Prof. Dr. O. Lundblad Juli-August 1935. IV. Araneae, Opiliones und Pseudoscorpiones. — Ark. Zool. 30 A (7): 1—42, Fig. 1—12, Pl. 1—4.

Schmidt, G. E. W., 1975a. Spinnen von Gomera. — Zool. Beitr., Berlin, N.F. 21: 219—231, Fig. 1—10.

———, 1975b. Spinnen von La Palma. — Zool. Beitr., Berlin, N.F. 21: 233—237, Fig. 1—2.

Schmölzer, K., 1962. Die Kleintierwelt der Nunatakker als Zeugen einer Eiszeitüberdauerung. — Mitt. Zool. Mus. Berlin 38: 171—400, Fig. 1—17.

Simon, E., 1884. Les Arachnides de France 5 (2): 181—420, Fig. 1—198, Pl. 26. — Paris.

———, 1892. [Liste d'Arachnides recueillis en Islande par M. C. Rabot.] — Ann. Soc. Ent. France 60, Bull.: clxxvi-clxxvii.

———, 1897. Arachnides recueillis à l'île Madère par M. A. Fauvel en 1896. — Bull. Soc. Ent. France 1897: 111—113.

———, 1929. Les Arachnides de France 6 (3): 533—772, Fig. 813—1112. — Paris.

Six, G. A., 1858. Lijst van spinnen in de provincie Utrecht gevonden en gedetermineerd. In: J. A. Herklots, Bouwstoffen voor eene fauna van Nederland 2: 292—302.

Strand, E., 1903. Theridiiden aus dem westlichen Norwegen. — Bergens Mus. Aarbog 6: 1—23, Fig. 1—3.

Thorell, T., 1856. Recensio critica Aranearum Suecicarum quas descripserunt Clerckius, Linnaeus, De Geerus. — Nov. Acta Reg. Soc. Sci. Upsaliensis (3) 2 (1): 61—171.

Vilbaste, A., 1973. [On the structure and seasonal dynamics of the spider fauna of Estonian mesotrophic peat-land forests.] — Eesti NSV Teaduste Akadeemia Toimetised 22, Biol.: 210—225.

Wanless, F. R., 1971. The female genitalia of the spider genus *Lepthyphantes* (Linyphiidae). — Bull. Brit. Arachn. Soc. 2: 20—28, Pl. 1—7.

———, 1973. Idem, II. — Bull. Brit. Arachn. Soc. 2: 127—142, Pl. 1—9, Fig. 24.

Wider, 1834. Arachniden. In: A. Reuss, Zoologische Miscellen. — Mus. Senckenb. 1: 195—276, Pl. 14—18.

Wiehle, H., 1956. Spinnentiere oder Arachnoidea (Araneae). 28. Familie Linyphiidae-Baldachinspinnen. — Tierw. Deutschl. 44: i-viii, 1—337, Fig. 1—551. — Jena.

Wolf, B., 1934—1937. Animalium cavernarum catalogus 3: 1—918.

Zorsch, H. M., 1937. The spider genus *Lepthyphantes* in the United States. — Amer. Midland Natural. 18: 856—898, Fig. 1—93.

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